Tom Dempsey

GAMES and GRAPHICS FOR THE TRS-80®

a BEGINNERS' GUIDE

For Models I & III

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Tom Dempsey

GAMES and GRAPHICS FOR THE TRS-80®

a BEGINNERS GUIDE

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Reading the Programs

The BASIC listings in this book were printed using the program DOCLIST/BAS from *Basic Faster and Better* by Lewis Rosenfelder (available from your local computer store, bookseller, direct from IJG Inc., or Radio Shack, cat. no. 62-1002). DOCLIST/BAS puts each statement on a separate line, inserts spaces between each key word and indents IF-THEN statements and FOR-NEXT loops. In addition, DOCLIST prints a solid underline after each section in the logic, and a dotted underline is used to highlight breaks in the logic.

Also, DOCLIST has a heading which shows the program name and page number, and it correctly processes programs which use the down arrow to provide a line feed to the next line. Blanks which may be in the program are ignored unless they are within quotes or remark statements. We believe DOCLIST enhances the readability of BASIC listings as well as making the program logic more transparent.

Below is a sample program listing before using DOCLIST/BAS.

```
51 X=5712:Y=Ø
52 C=PEEK(X):IFC>127THENPRINT@544,RW$(Y),:Y=Y+1:IFY>123THEN55ELS
ERW$(Y)=CHR$(CANDNOT128):GOTO54
53 RW$(Y)=RW$(Y)+CHR$(C)
54 X=X+1:GOTO52
55 RW$(16)=RW$(16)+""
```

Here is the same program after using DOCLIST/BAS.

```
51 X = 5712:
   Y = Ø
52 C = PEEK (X):
   IF   C > 127
   THEN PRINT @544,RW$(Y),:
        Y = Y + 1:
        IF   Y > 123
        THEN 55: ..........................................
        ELSE RW$(Y) = CHR$ (C AND NOT 128):
             GOTO 54 ......................................
53 RW$(Y) = RW$(Y) + CHR$ (C)
54 X = X + 1:
   GOTO 52
-------------------------------------------------------------
55 RW$(16) = RW$(16) + ""
```

Note the solid underline, separating lines 54 and 55, which indicates that the logic never falls directly through from 54 to 55 in this program. The dotted lines in line 52's IF-THEN statement indicate possible logic breaks, but the absence of a solid underline before line 53 shows that conditions exist in which the logic will fall through from line 52 to 53.

When typing in programs from this book, data statements should not have spaces inserted where DOCLIST has broken the lines for readability.

Preface

This book is especially designed for the new computer owner, as well as those who have been programming for years.

If you enjoy playing computer games, watching good graphics or perhaps would like to learn a few programming tricks, then this book is for you. If you also happen to have children who love computer games, the games in this book will keep them busy for days.

The microcomputer can do a great many things — keeping track of expenses, keeping your records straight, accounting, designing, estimating, educational uses, or even dialing your telephone. But among the many, many uses for a home computer, the most enjoyable is just playing games. The computer can be programmed to play any game you can think of.

The object of this book is not only to give you program listings that you can enter and run, but, more importantly, to give you ideas on how to make your own computer games using animation and graphics.

If you have been programming for awhile but would like some new ideas on how to create realistic-looking graphics and animation for your games, the programs in this book will help you. Each listing contains new ideas and methods for giving animation and graphics to your games.

In the game SLOT MACHINE, you'll see fast graphics animation using only SET and RESET. And the game SPEED RACER will show you new ways of displaying text or instructions on the screen. We'll investigate the use of machine-language subroutines to speed up the graphics, as well as ways to let the computer do some of the work for us by using some simple programming utilities.

As we write our games, we will be concentrating on a few (but very powerful) routines that are available in BASIC and especially useful for graphics:

1. Memory Usage — how programs are stored in memory, special address locations and the video display.

2. Graphic Codes — using the 64 graphic codes and alphanumeric graphics.

3. Programming Graphics — making the most out of SET and RESET, letting the computer figure out the PRINT@ and POKE positions, and using string packing so our graphics characters are in the program lines to increase the speed of the graphics. At the same time, we don't have to reserve or clear any space in our programs for these graphics because they are actually contained in the program lines themselves.

4. Block Move Routines — which will move our graphics from the program lines and place them on the video screen.

5. Drawing and Animation — programming utilities that we can use for creating our graphics characters and giving them animation.

6. Ideas and Suggestions — tips on how to create your own games by using the utilities in this book, to help you turn your ideas into reality.

I hope you enjoy reading and using the ideas in this book as much as I have enjoyed writing and playing the games with my family.

ACKNOWLEDGMENTS

I would like to thank:

My wife Judy, who let me quit 15 years of servicing office machines and supported our family while I sat in front of my computer writing games.

Bob Jones (Interface Age), who looked at my first manuscript and instead of telling me to forget it, gave me the encouragement I needed to keep going.

Vince Oehrlein, who introduced me to Electric Pencil, which ended up changing my method of earning a living.

And Harv Pennington, whose creative genius and compassion for his fellow man helped make this book a reality.

Thomas Dempsey

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Why

I was born in Chicago, Illinois on May 4, 1943 and lived there for about 2 years — just long enough to fall off the kitchen table and break my left arm. I guess that has a little to do with why I can do things just as well with either hand. Everything but writing,that is — my writing is so bad I have to print everything so I can read it *myself*!

My family moved to a small, 1-acre chicken farm in Downers Grove, a suburb of Chicago. I always called it a chicken farm because there were more chickens than stray cats running around, although at times it was hard to be sure.

I look back at that stage of my life as perhaps the best and worst times of growing up. At that time I had three brothers, one sister, about 100 chickens (99 chickens — a chicken hawk carried another one away last night), 40 cats, 1 dog, 5 ducks, 4 turkeys and one old work horse.

The chickens provided us with eggs most of the time, and I could write a book on all the ways our dear mother found to cook chicken. The cats gave us kids the most enjoyment. We used to throw them up in the air just to see if they would always land on their feet — they did, except for the one we threw over the house. That one never came back!

The cats always teased the German Shepherd until the day he got smart — instead of running out to the full length of his chain he started stopping about a foot short. I don't have to tell you the rest of the story . . .

The ducks were cute, the turkeys we saved for that special day, and the old horse walked around the post he was tied to until he just fell over and died.

I think every child should be able to experience growing up on a farm with no running water, a coal stove that has to be fed in the middle of the night so you won't wake up frozen, and a little house about 100 feet from the main house that we used to visit in the middle of the night with a flashlight in one hand and a newspaper in the other to chase the cat off the seat. This kind of life tends to give one a much deeper appreciation of the finer things in life. I enjoyed it as a kid, but I don't think I would ever go back.

After about 11 years on the farm, fighting asthma and hayfever so bad that I had to sleep sitting straight up, we moved to Lombard, Illinois, another suburb of Chicago. We were really living in style now — we even had running water! I lived there until I was out of school. In my first year of working for a living I held over 18 jobs, which I think must be some kind of record!

While I was busy finding myself, I met a woman, and we decided to get married three months later. We're going on 20 years now — and they said it would never last! I kept trying out different jobs at the rate of about 10 per year, and then I slowed down. I'm not sure whether I got tired or I just ran out of places, but one time when I was out of work I walked into a company called Smith-Corona, where I repaired office equipment for about 20 years.

One thing I noticed was that off and on during my office-machine repairing days I always kept going back to artistic types of jobs. I worked for Sears & Roebuck as a paste-up and layout artist for one of their 17 vice presidents. I painted oil paintings, — one of my famous paintings is hanging in my mother's house.

My technical training was on IBM, Royal, Smith-Corona, Remington, Adler and Olivetti typewriters, as well as Smith-Corona, Royal, Adler, Remington, Minolta, Olivetti and 3-M copy machines. One of my most enjoyable jobs was as a regional service instructor for Graphic Communications, but I had to leave that position when I discovered I didn't like flying.

Then it happened! I was out of work for about 3 months one time (I thought of it as early retirement) and I was walking past a Radio Shack store, when I looked through the window and saw a computer.

I went into the store and asked the owner a few questions like, "Just how much can I do with this computer?" The owner told me he had his own machine and that it was possible to do just about anything you could imagine! I thought to myself, "Wow, with an imagination like mine that means just about anything would be possible!"

I must have stood in front of that computer for 3 hours just thinking about what commands I could give that machine, when a little light turned on inside my head and I said to myself, "This machine can take my creative ideas and turn them into real pictures." It's like fixing office machines, it's like building skyscrapers with Tinker Toy parts and never running out of parts, it's like painting on a canvas and never running out of paint . . .

Well, the rest of the story is just beginning. I took out my life savings (about $600.00), told my wife I might as well learn something new while I was out of work and told the owner of the store to gift wrap it! That was three years ago, and for the last three years I've spent no less than 14 hours a day, 7 days a week in front of this extension of my mind. I wonder if there are computers in heaven?

Introduction

What is it that makes games (or to be more specific, — games using graphics) so enjoyable to so many people?

The human brain is a very hungry thing, and even more interesting is the fact that we can never fill it or use it to its full capacity. I can even see a small similarity between the brain and one of the computer spelling programs I have.

Each time I tell the program to remember a new word, the program saves this new word on the disk, and as the program keeps learning new words, it keeps pushing the old words that I don't use very much farther and farther back in the file until they disappear.

Our minds work in a similar manner, except that they don't ever completely forget anything. The mind keeps pushing information farther back too, but it saves all these bits of information and also has the ability to combine and compact this code when needed, — or as much as is needed at any given moment.

Whenever we need to restore this information, we might only need to take a quick refresher course on an old subject and BINGO — our minds bring all this old information back into the main working-memory area. Sounds like I'm talking about a computer with disk drives, doesn't it? I doubt very much that we will ever come close to making a computer as good as the human brain.

I guess what I'm trying to say is that the mind never seems to get enough information. People are not satisfied with just hearing music, — they also want to see music with their eyes and feel it. This urge for new ways to experience different things in the world is what I believe is the key to what makes games using graphics and sound so popular. The more graphics, sound, and animation we get, the more these games become extensions of the world we live in.

Games and graphics are all around us. Everything we look at is graphics, and I won't even try to mention all the different types of games people play, not only with other people or computers, but with themselves also.

Sometimes a game might create a world we would like to live in and experience, but we can only do so through our computers. I think the day is coming when people will no longer be satisfied with merely watching movies or computer simulations.

The future will bring people who want to actually live out experiences in real-life fantasy worlds which man will create. Someday, we may go to a place like Disneyland, sit down in the cockpit of a spaceship fighter-simulator and fly out to other worlds, shooting our laser-beam guns and conquering other solar systems.

1

Eight Bits Equal One Byte

A shave and a haircut used to cost 1/4 of a byte. Today it's more like a sting than a byte! The TRS-80 saves numbers in memory as bytes.

The largest number the computer can save in one byte (or one memory location) is 255. If we want to save a number like 15360 in memory, we have to break this large number into two smaller numbers. The method we use to get these two numbers is shown below:

```
MS = INT(15360/256)
LS = 15360 - MS*256
```

LS is just a variable we use to store the Least Significant Byte, and MS contains the Most Significant Byte. The Least Significant Byte is saved first in memory, and the Most Significant Byte is saved in the following memory location. So our number 15360, saved in memory starting at (let's say) memory location 17129, would look like this in memory:

```
17129 0
17130 60
```

Point Me in the Right Direction

The following is a BASIC program and how it looks in memory:

Figure 1.1 *A BASIC Program in Memory*

```
10 CLS
20 PRINT"HELLO"
30 END

27206 76          LS AND
27207 106         MS OF STARTING ADDRESS OF LINE 20
27208 10          LS AND
```

```
27209 0          MS OF LINE NUMBER 10
27210 132        CLS
27211 0          END OF LINE
27212 89         LS AND
27213 106        MS OF STARTING ADDRESS OF LINE 30
27214 20         LS AND
27215 0          MS OF LINE NUMBER 20
27216 178        PRINT
27217 34         "
27218 72         H
27219 69         E
27220 76         L
27221 76         L
27222 79         O
27223 34         "
27224 0          END OF LINE
27225 95         LS AND
27226 106        MS OF STARTING ADDRESS OF NEXT LINE
27227 30         LS AND
27228 0          MS OF LINE NUMBER 30
27229 128        END
27230 0          END OF LINE
27231 0          LS AND
27232 0          MS = NULL END OF PROGRAM
```

Right about now you're probably saying okay, but how does the computer know how to find the first line in the program? That's easy, — it saves the starting address of the program in memory locations 16548 and 16549, and it saves the end of the program in locations 16633 and 16634.

Any time we need to know where our program starts, we can use the following command:

PRINTPEEK(16549)*256+PEEK(16548)

If we need to know where the program ends in memory, we can use this command:

PRINTPEEK(16634)*256+PEEK(16633)

To find out how much memory we have left to use, we can use this command:

PRINTMEM

If we want to find out what size machine our program is running in, we can use this command:

PRINTPEEK(16561)+PEEK(16562)*256

To check whether the computer has tape or disk, we can use this command:

IF PEEK(16396) = 201 THEN IT'S TAPE
ANY OTHER NUMBER MEANS DISK

If we want to PEEK or POKE into memory locations higher then 32767, we can use the following:

A = -1*(65536 - ADDRESS) : PRINTA

The following short program will search through memory and print out a list of keywords for you:

Figure 1.2 *Keyword Search Program*

```
10 CLS
20 FORX=5711TO6175
30 P=PEEK(X):IFP>90THENP=P-128:PRINTA$,:A$=""
40 A$=A$+CHR$(P):NEXTX
```

NOTES

2

What Kind of Character Are You?

The TRS-80 uses memory locations 15360 through 16383 for the video monitor. This 1K of memory is what we will be working with most in our games or graphics programming. You have to get to know and respect it in order to get the most out of it.

Some of its don't rules are listed below:

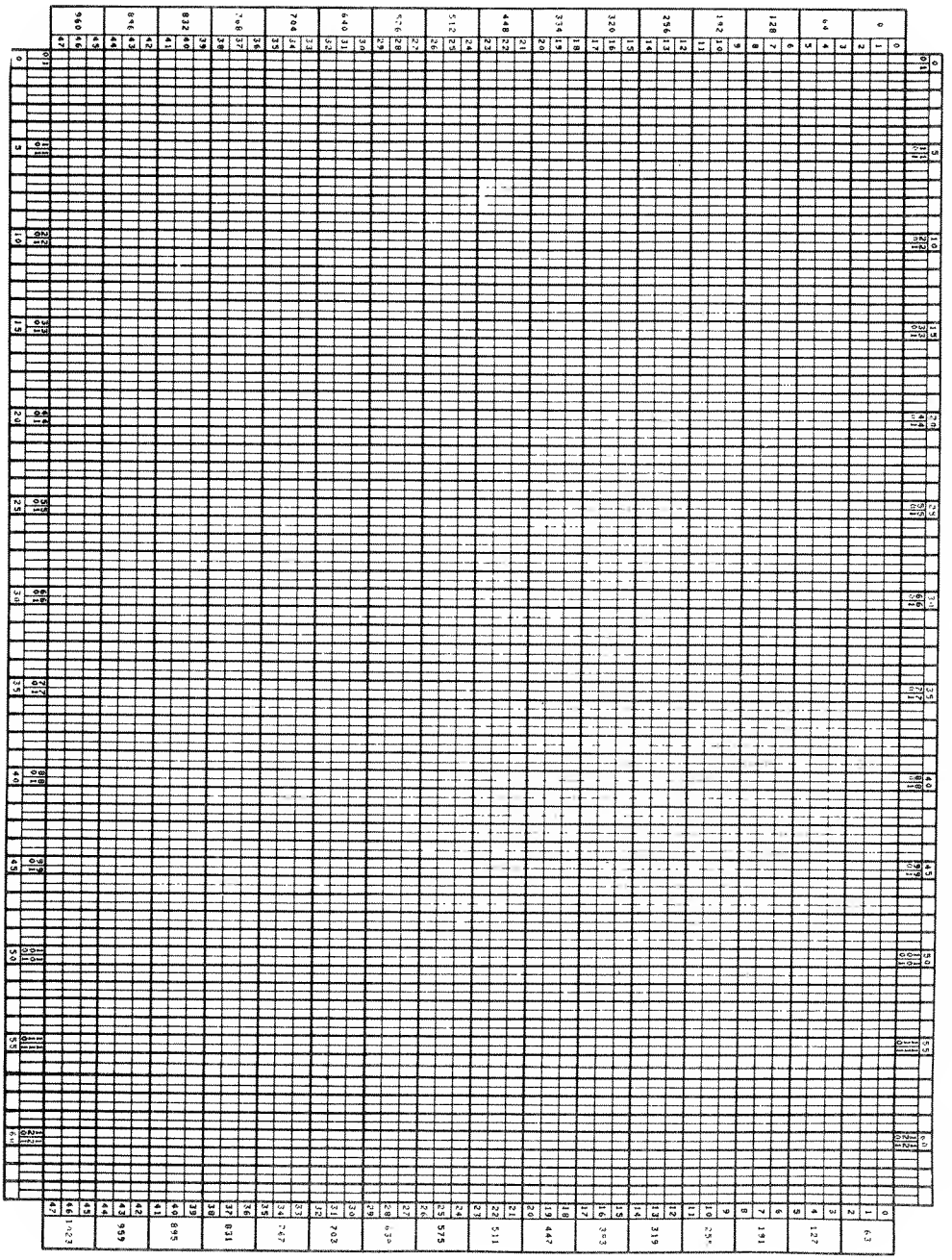
1. Don't PRINT @ 1023.
2. Don't POKE Lower than 15360.
3. Don't POKE higher than 16383.
4. Don't SET X coordinates lower than 0 or higher than 127.
5. Don't SET Y coordinates lower than 0 or higher than 47.

Divide and Conquer

The screen is divided into 64 PRINT positions across by 16 rows down, and it is further divided by 127 SET positions across and 47 SET positions down.

We have 64 graphics characters to work with, as well as the alphanumeric characters which we can use when we need higher resolution for certain graphic effects.

Figure 2.1 *Video Graphics Worksheet*



The following short program will display the 64 graphics characters on your screen.

Figure 2.2 *Graphics Display Program*

```
10 CLS
20 FORX=128TO191:PRINTX;" ";CHR$(X);
30 T=T+1:IFT=9THENPRINT" ":T=0
40 NEXT
50 GOTO 50
```

This program was originally a one-liner, but for demonstration purposes I kept it nice and neat.

A Different Kind of Graphics

The following program is called MACHINE PARTS and is a good example of the use of alphanumeric graphics.

As a fellow ccmputer-lover, I hear quite often from other programmers that the screen is not very good for doing any kind of graphics that requires finely-detailed pictures. I believe the graphics are there, but it's just a matter of learning how to express them in a new way. For this reason, I wrote MACHINE PARTS GRAPHICS. The computer is able; it's just a matter of learning either how to work around a few things or new ways to write the program. We are not limited to 64 graphics characters. We also have all our letters and numbers to make use of.

This program does just that. I think if it's possible to draw machine parts, it should be possible to express any graphics picture. The important thing to remember is this: It's possible for our eyes to see things that are not really there or do not exist at all! With this fact in mind, all we must do is create a close resemblance of what we want the players to see (the *appearance* of motion) and let their eyes and minds do the rest. The human eye is much slower than the computer graphics; our brain retains a picture of what the eye sees long after it has gone from view.

This program uses these rules to our advantage. There are many more ways to take advantage of tricks on the eyes. The main idea I'm trying to convey in this short program is this: Don't neglect to make the most of what you have to work with!

In MACHINE PARTS GRAPHICS, I have used the combination of graphics characters and alphanumeric characters to form a picture which we can interpet as machine or mechanical parts.

A Little Imagination Goes a Long Way

You don't have to be an artist to make use of these principles. What you must do is learn to see things and shapes in their simplest forms.

First, look at the object you want to duplicate as a complete unit. Then draw a mental outline of the complete picture. The outline must contain the important features of the picture. Let's take, for example, a picture of a horse.

Now at first, you might not think of a horse as either being very mechanical or having the least resemblance to a machine, but the beauty and speed of a horse is a very great achievement. First, we have a very long body with two legs at each end, — very long and skinny legs for such a large body. And, much to our amazement, this animal can run very fast. Not only that, but it can also do this while carrying a rider on its back!

Okay, we have thought about this horse long enough. Now it's time to put his picture on the screen. First, we want to draw the outline of a horse. It's not important to show the fine details, such as the eyes or ears at this stage, — if we can just get the outline of a horse on the screen, everyone will know what it is.

If we want to show movement, we must show what creates this movement, but it's going to be hard to show the bones or muscles of the horse with our graphics. But wait! There's an easier way, — all we have to show is the shadows of those things.

The eyes can see an object not only by looking at the object itself, but also by looking at the absence of the object. Take, for example, a square drawn in the middle of your screen. We can draw the square and fill it completely in, or we can fill in everything around our square. The end result is still a square in the middle of the screen. Thinking negatively isn't always bad . . .

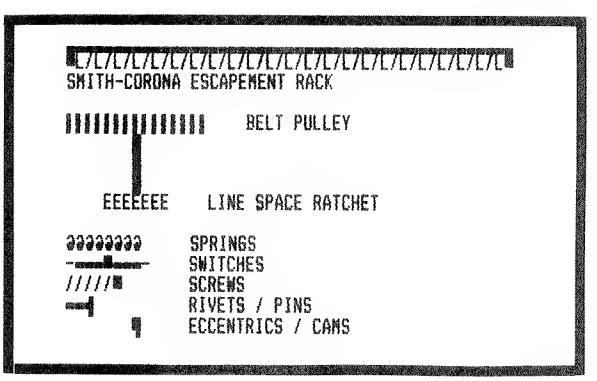


Figure 2.3 *Machine Parts Program*

```
 10 CLS
 15 CLEAR 1000
 20 A$ = CHR$ (143) + "L/L/L/L/L/L/L/L/L/L/L/L/L/L/L/L/L/L
    /L/L/L/L/L/L" + CHR$ (143)
 30 B$ = STRING$ (47,176)
 40 PRINT B$
 50 PRINT A$
 60 PRINT "SMITH-CORONA ESCAPEMENT RACK"
 65 PRINT
 70 A$ = STRING$ (15,149)
 80 B$ = "    EEEEEEE"
 90 PRINT A$ + "    BELT PULLEY"
100 FOR  X = 1 TO 3:
         PRINT TAB( 7) CHR$ (191):
    NEXT
110 PRINT B$ + "    LINE SPACE RATCHET"
120 PRINT
130 A$ = "@@@@@@@@     SPRINGS"
140 B$ = "-" + STRING$ (3,140) + CHR$ (143) + STRING$ (3
    ,140) + "-    SWITCHES"
150 PRINT A$
160 PRINT B$
170 A$ = "/////" + CHR$ (143)
180 PRINT A$ + "       SCREWS"
190 A$ = CHR$ (140) + CHR$ (140) + CHR$ (174)
200 PRINT A$ + "          RIVETS / PINS"
210 A$ = CHR$ (175)
220 PRINT "       " + A$ + "     ECCENTRICS / CAMS"
500 GOTO 500
```

NOTES

3

How to Get Ideas

The creation of a game has first to start with some idea of what type of game you're trying to write. Let's list some of the different types of games we could write.

WORD GAMES
NUMBER GAMES
GRAPHIC GAMES

If we were to place all games into one of these three categories, we could say that a game like POKER would fall under the heading of a NUMBER GAME. At the same time, if we make pictures of cards on the computer screen, then we might call the game POKER a GRAPHIC NUMBER GAME.

Creating a Character

Since most of my games are about different types of characters, let's see how I go about creating a game program. The first thing I do is try to think of a graphic character. Most people would all look the same using the low resolution of the video monitor, so we will overlook using some of the characters we might already know.

How about animals, — any kind of animal will do! Maybe a horse, dog, cat, or a mouse (Oops! Sorry about that Walt). How about a *fish*? Okay, let's use a fish for our character.

The Right Background

Now comes the big question. What does a fish do? Think about this for a moment, and also think about what other people would give you for an answer to this question.

The first thing that comes to my mind about a fish is water. Most fish that we know swim in the water, right? Now what else do most fish do? Who was that in the back of the room that said, "Have babies!"

Well, since we don't want to end up with a screen full of little fish in our computer, we could say that fish eat food. But since dropping fish-food into a fish tank is not my idea of an exciting day, let's forget about what else fish do and think for a moment about what people do to fish . . .

Where's the Action?

People catch fish, right? Or I should say most of us have *tried* to catch a fish. Now we already have the most important pieces for our new game.

First, the fish is swimming in the water, and second, the player is trying to catch the fish. Wow! I think we have a good idea for a complete game. Let's get out our video worksheets and draw a picture of a fish. Try not to make him too square-looking.

Giving Your Characters Some Character

See, you don't have to be a creative genius to think up a character for a game, — although it wouldn't hurt if we *were*.

Now that we have our fish, we should try to give him some kind of personality. Let's make him clever by letting him swim around in the water and give him the ability to swim in any direction he wants.

We can make him smart by letting him swim faster when the hook is in the water with the worm on it, and we can make him look real by letting him open and close his mouth any time he wants to. We can even make him look funny by giving him a big grin if he beats us or wins the game. Let's see how our fish game turns out when it's all done.

A Game Called JAWS

This program should really be called JAWS PART 2. In the original version of this game, I had the player dropping food into a fish tank, and wherever the food was dropped, JAWS would go after it and eat the food.

This version also became very messy because JAWS didn't eat his food all the time. We soon realized the need for a snail in the tank with JAWS. Then one day, my wife said she thought JAWS was lonely and that I should add another fish to keep JAWS company.

You guessed it! JAWS kept trying to eat the nice little angel fish I put in the tank! That's how this version of JAWS came about.

The Object of the Game

The object of the game is to drop your hook into the water, and just before JAWS gets too close, pull your line out of the water by pressing the up-arrow key. If your timing is good, you can catch JAWS on your hook!

To continue playing, just press the down-arrow quickly, and JAWS will drop back into the water. Press the down-arrow a second time, and your hook will go into the water again.

Programming Tricks

One of the programming tricks used in JAWS to make the graphics faster is that when we print our graphics for JAWS on the screen, we also print a character 128 before and after JAWS.

This eliminates the need to have an extra print statement in our code just to clear JAWS each time we move him across the screen. This method clears the previous JAWS each time we print the new JAWS.

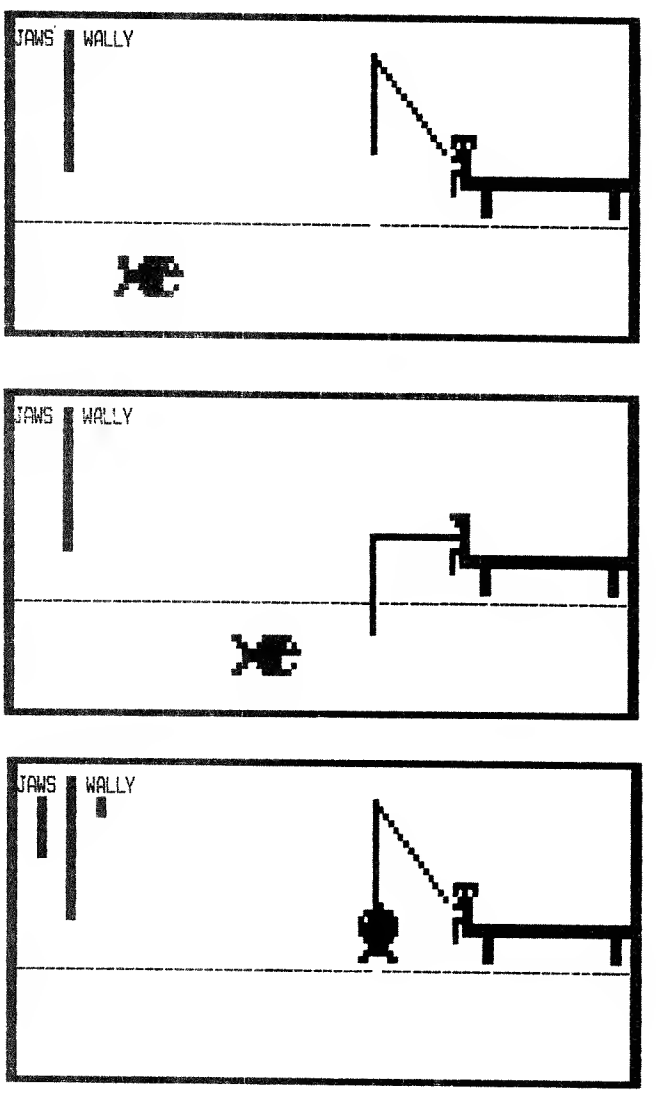


Figure 3.1 *Jaws Program*

```
10 REM  *** JAWS BY TOM DEMPSEY ***
15 REM  ============================
          PRINT INSTRUCTIONS
          ============================
20 CLEAR 1000
30 T = 131:
   WO = 137
40 CLS :
   PRINT CHR$ (23):
   PRINT @462,"**** J A W S ****":
   FOR  X = 1 TO 1000:
   NEXT :
   PRINT :
   INPUT "ENTER FIRST NAME";I$:
   CLS
50 CLS :
   PRINT "THE OBJECT IS TO CATCH JAWS BEFORE HE GETS YO
   UR BAIT":
   PRINT :
   PRINT "USE THE DOWN ARROW TO PLACE LINE IN WATER":
   PRINT "AND THE UP ARROW TO LIFT IT OUT":
   PRINT :
   PRINT "REMEMBER, IF YOU PULL YOUR LINE OUT OF THE WA
   TER WITHOUT JAWS ON ";
60 PRINT "THE END, THEN HE SCORES A POINT"
70 PRINT :
   INPUT "TO PLAY HIT ENTER";I1$:
   CLS
75 REM  ============================
          JAWS MOVING RIGHT
          ============================
80 F1$ = CHR$ (128) + CHR$ (139) + CHR$ (180) + CHR$ (1
   84) + STRING$ (2,191) + CHR$ (183) + CHR$ (180)
90 F2$ = CHR$ (128) + CHR$ (184) + CHR$ (135) + CHR$ (1
   39) + STRING$ (3,191) + CHR$ (135)
100 F3$ = CHR$ (128) + CHR$ (138) + CHR$ (181) + CHR$ (1
   84) + STRING$ (2,191) + CHR$ (183) + CHR$ (180)
110 F4$ = CHR$ (128) + CHR$ (168) + CHR$ (151) + CHR$ (1
   39) + STRING$ (3,191) + CHR$ (135)
115 REM  ============================
          JAWS MOVING LEFT
          ============================
120 F5$ = CHR$ (128) + CHR$ (184) + CHR$ (187) + STRING$
   (2,191) + CHR$ (180) + CHR$ (184) + CHR$ (135) + CHR$
   (128)
130 F6$ = CHR$ (128) + CHR$ (139) + STRING$ (3,191) + CHR$
   (135) + CHR$ (139) + CHR$ (180) + CHR$ (128)
140 F7$ = CHR$ (128) + CHR$ (184) + CHR$ (187) + STRING$
   (2,191) + CHR$ (180) + CHR$ (186) + CHR$ (133) + CHR$
   (128):
```

```
    F8$ = CHR$ (128) + CHR$ (139) + STRING$ (3,191) + CHR$
    (135) + CHR$ (171) + CHR$ (148) + CHR$ (128)
145 REM  ==============================
            MOUTH OPEN MOVING RIGHT
            ==============================
150 O1$ = CHR$ (128) + CHR$ (139) + CHR$ (180) + CHR$ (1
    84) + STRING$ (2,191) + CHR$ (183) + CHR$ (180) + CHR$
    (128):
    O2$ = CHR$ (128) + CHR$ (184) + CHR$ (135) + CHR$ (1
    39) + STRING$ (2,191) + CHR$ (176) + CHR$ (132) + CHR$
    (128)
155 REM  ==============================
            MOUTH OPEN MOVING LEFT
            ==============================
160 O3$ = CHR$ (128) + CHR$ (184) + CHR$ (187) + STRING$
    (2,191) + CHR$ (180) + CHR$ (184) + CHR$ (135) + CHR$
    (128):
    O4$ = CHR$ (128) + CHR$ (136) + CHR$ (176) + STRING$
    (2,191) + CHR$ (135) + CHR$ (139) + CHR$ (180) + CHR$
    (128)
165 REM  ==============================
            JAWS HANGING BY HOOK
            ==============================
170 W1$ = CHR$ (160) + CHR$ (172) + CHR$ (191) + CHR$ (1
    88) + CHR$ (144)
180 W2$ = CHR$ (138) + STRING$ (3,191) + CHR$ (133)
190 W3$ = CHR$ (160) + CHR$ (158) + CHR$ (143) + CHR$ (1
    73) + CHR$ (144)
195 REM  ==============================
            GRAPHICS FOR PIER
            ==============================
200 PRINT CHR$ (191) + STRING$ (62,131) + CHR$ (191);:
    FOR  X = 1 TO 14:
         PRINT CHR$ (191) + STRING$ (62,128) + CHR$ (191
         );:
    NEXT :
    PRINT CHR$ (191) + STRING$ (62,176);:
    POKE 16383,191
210 P1$ = STRING$ (2,143) + CHR$ (191) + STRING$ (12,143
    ) + CHR$ (191) + STRING$ (2,143):
    P2$ = CHR$ (191) + STRING$ (12,128) + CHR$ (191):
    M1$ = CHR$ (139) + CHR$ (191):
    M2$ = CHR$ (179) + CHR$ (191):
    M3$ = CHR$ (149)
220 PRINT @558,P1$;:
    PRINT @624,P2$;:
    PRINT @429,M1$;:
    PRINT @493,M2$;:
    PRINT @557,M3$;:
    PRINT @641, STRING$ (62,"-");:
    POKE 15935,191
```

```
230 A = 769:
    GOSUB 440
235 REM  ==============================
             PRINT SCORE KEEPER
             ==============================
240 PRINT @65,"JAWS";:
    PRINT @72,I$;:
    FOR  M = 3 TO 23:
         SET (12,M):
         SET (13,M):
    NEXT
250 A = 769:
    T1$ = F1$:
    T2$ = F2$:
    T3$ = F3$:
    T4$ = F4$:
    T5$ = F5$:
    T6$ = F6$:
    T7$ = F7$:
    T8$ = F8$
255 REM  ==============================
             CONTROL FOR JAWS SWIMMING
             ==============================
260 PRINT @A,T1$;:
    PRINT @A + 64,T2$;:
    PRINT @A,T3$;:
    PRINT @A + 64,T4$;
270 A = A + 1:
    IF   A = 823
    THEN 350 ..................................................
280 R = RND (10):
    IF   R = 1
    THEN T2$ = O2$:
         T4$ = O2$
290 IF   R = 10
    THEN T2$ = F2$:
         T4$ = F4$
300 R = RND (50):
    IF   R = 25
    THEN 360 ..................................................
310 IF   PEEK (14400) = 8 GOSUB 440
315 REM  ==============================
             IF JAWS MOUTH OPEN MAKE SOUNDS
             ==============================
320 IF   T2$ = O2$ FOR  X = 1 TO 4:
               OUT 255,0:
               OUT 255,2:
               NEXT
330      IF   PEEK (14400) = 16 GOSUB 500
340      GOTO 260 ..................................................
```

```
345       REM  ==============================
                  RE-DEFINE STRING FOR DIRECTION
                  ==============================
350       A = A - 1:
          IF   A = 769
          THEN 250 ..........................................
360       PRINT @A,T5$;:
          PRINT @A + 64,T6$;:
          PRINT @A,T7$;:
          PRINT @A + 64,T8$;
370       R = RND (10):
          IF   R = 1
          THEN T6$ = O4$:
               T8$ = O4$
380       IF   R = 10
          THEN T6$ = F6$:
               T8$ = F8$
390       R = RND (50):
          IF   R = 25
          THEN 260 ..........................................
395       REM  ==============================
                  CHECK IF PLAYER MOVES POLE
                  ==============================
400       IF   PEEK (14400) = 8 GOSUB 440
410       IF   PEEK (14400) = 16 GOSUB 500
420       IF   T6$ = O4$ FOR  X = 1 TO 4:
                    OUT 255,0:
                    OUT 255,2:
                    NEXT
430            GOTO 350 .....................................
-------------------------------------------------------------
435            REM  ==============================
                       GRAPHICS FOR BOY FISHING
                       ==============================
440            M = 165:
               PRINT @M + 320,"        ";:
               PRINT @M + 384," ";:
               PRINT @M + 448," ";:
               PRINT @M + 512," ";:
               PRINT @M + 576," ";
450            M = 165:
               PRINT @M, CHR$ (157) + CHR$ (144);:
               PRINT @M + 64, CHR$ (149) + CHR$ (130) + CHR$
               (164);:
               PRINT @M + 128, CHR$ (149) + STRING$ (2,12
               8) + CHR$ (137) + CHR$ (144);:
               PRINT @M + 192, CHR$ (149) + STRING$ (3,12
               8) + CHR$ (130) + CHR$ (164);
460            PRINT @M + 256, CHR$ (149) + STRING$ (5,12
               8) + CHR$ (137) + CHR$ (144);
470            PRINT @429, CHR$ (167) + CHR$ (183) + CHR$
```

```
                (133);
480             PRINT @A,"          ";:
                PRINT @A + 64,"          ";
490             RETURN  ..........................................
-------------------------------------------------------------------
495             REM  ============================
                        CHANGE JAWS DIRECTION
                        ============================
500             M = 165:
                PRINT @M,"  ";:
                PRINT @M + 64,"    ";:
                PRINT @M + 128,"      ";:
                PRINT @M + 192,"       ";:
                PRINT @M + 256,"         ";:
                PRINT @M + 320, CHR$ (151) + STRING$ (7,13
                1);:
                PRINT @M + 384, CHR$ (149);:
                PRINT @M + 448, CHR$ (149);:
                PRINT @M + 512, CHR$ (149);
510             PRINT @M + 576, CHR$ (149);:
                PRINT @429, CHR$ (139) + CHR$ (191) + CHR$
                (128);
520             H = 805
530             IF   A < H
                THEN 620 ........................................
540             IF   A > H
                THEN 560 ........................................
550             IF   A = H
                THEN 680 ........................................
560             PRINT @A,O3$;:
                PRINT @A + 64,O4$;
570             A = A - 1
575             REM  ============================
                        CHECK IF JAWS GETS CAUGHT
                        ============================
580             IF   PEEK (14400) = 8 AND A > H GOSUB 720:

                     GOTO 440 ...................................
590             IF   PEEK (14400) = 8 AND A = H
                THEN 770 ........................................
600             IF   A < H
                THEN 680 ........................................
610             GOTO 560 ........................................
-------------------------------------------------------------------
620             H = 798:
                PRINT @A,O1$;:
                PRINT @A + 64,O2$;
630             A = A + 1
640             IF   PEEK (14400) = 8 AND A < H GOSUB 720:

                     GOTO 440 ...................................
```

```
650           IF   PEEK (14400) = 8 AND A = H
              THEN 770 ..........................................
660           IF   A > H
              THEN 680 ..........................................
670           GOTO 620 ..........................................
-------------------------------------------------------------------
675           REM  ==============================
                       PRINT JAWS GETTING HOOKED
                       ==============================
680           PRINT @A,"          ";:
              PRINT @A + 64,"          ";
690           PRINT @A - 64,W1$;:
              PRINT @A,W2$;:
              PRINT @A + 64,W3$;
700           PRINT @A - 64,"          ";:
              PRINT @A,"          ";
710           PRINT @A + 64,"          ";
720           PRINT @T, CHR$ (191);:
              T = T + 64
730           PRINT @A,"            ";:
              PRINT @A + 64,"            ";
740           PRINT @A, CHR$ (184) + CHR$ (187) + CHR$ (
              143) + CHR$ (191) + CHR$ (180) + CHR$ (184
              ) + CHR$ (135);:
              PRINT @A + 64, CHR$ (136) + STRING$ (2,188
              ) + CHR$ (191) + CHR$ (135) + CHR$ (139) +
              CHR$ (180);
750           IF   T = 515 FOR  X = 1 TO 100:
                           PRINT @65,"JAWS";:
                           PRINT @65,"    ";:
                           OUT 255,0:
                           OUT 255,2:
                           NEXT :
                           FOR  T = 131 TO 515 STEP 64:
                                PRINT @T, CHR$ (128);:
                                PRINT @T + 6, CHR$ (128);:
                                NEXT :
                                T = 131:
                                WO = 137:
                                PRINT @65,"JAWS";:
760                        RETURN  ..............................
-------------------------------------------------------------------
770                        GOSUB 440
780                        M = 483
790                        PRINT @A,"          ";:
                           PRINT @A + 64,"          ";
800                        PRINT @M,W1$;:
                           PRINT @M + 64,W2$;:
                           PRINT @M + 128,W3$;
810                        PRINT @WO, CHR$ (191);:
                           WO = WO + 64
```

```
820                     IF   PEEK (14400) = 16
                        THEN PRINT @M,"       ";:
                             PRINT @M + 64,"        ";:
                             PRINT @M + 128,"       ";:
                             RETURN  .........................
825                     REM  ============================
                        ===
                                END OF GAME
                                ========================
                        ======
830                     IF   WO = 521 FOR  X = 1 TO 100:

                                   PRINT @72,I$;:
                                   PRINT @72,"
                                             ";:
                                   OUT 255,0:
                                   OUT 255,2:
                                   NEXT :
                                   FOR  WO = 137 TO 521 STEP
                                        64:
                                        PRINT @WO, CHR$ (
                                        128);:
                                        PRINT @WO - 6, CHR$
                                        (128);:
                                        NEXT :
                                        T = 131:
                                        WO = 137:
                                        PRINT @72,I$;
840                                GOTO 820 ...................
```

4

Methods of Display Using PRINT @

The PRINT @ command allows us to print words and graphics on the screen at any of 1023 different positions. For most of our work with graphics and animation, we will not be using the last position (1023), but this position does come in handy when we want to scroll the screen up for different graphic effects.

The following program is called ROBOT BUILDER and is a good example of using the PRINT @ command.

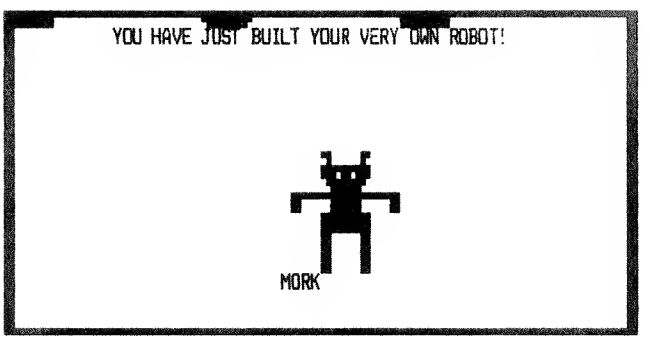
ROBOT BUILDER

This is one of my favorite programs because it lets the user be creative, and it gives the user most of the control over the outcome of the program.

This is great for children who need to feel creative but do not have the programming experience to draw a robot on the screen. By using multiple-choice questions we can give them this ability.

These same ideas can be used for a great many educational games or learning-aids. Another good use for computer instruction is in the hand-eye coordination field for children who have learning disabilities. We have used this for our son, and it has helped to improve his control and hand-eye reflexes to a great degree.

The program uses a very small amount of string$ to create a very large number of pictures, — about 71 possible combinations in all! This gives the program the staying power to keep a child interested for quite some time.


YOU HAVE JUST BUILT YOUR VERY OWN ROBOT!
MORK


CHOOSE THE TOP OF THE HEAD YOU WANT? 3
MORK

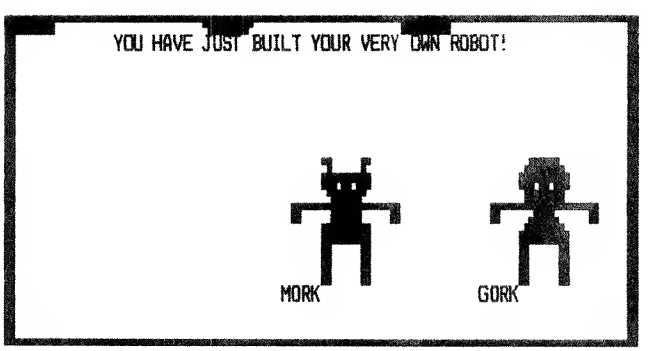

YOU HAVE JUST BUILT YOUR VERY OWN ROBOT!
MORK
GORK

Figure 4.1 *Robot Builder Program*

```
 10 CLS :
    CLEAR 1000
 20 PRINT CHR$ (23):
    PRINT @448,"THE ROBOT BUILDER GAME"
 30 PRINT :
    PRINT "NAME OF ROBOT #1";:
    INPUT P1$
 40 PRINT "NAME OF ROBOT #2";:
    INPUT P2$
 50 CLS
 60 R = 0
 70 A = 1:
    GOSUB 140:
    PRINT @0,TH$;
 80 A = 2:
    GOSUB 140:
    PRINT @20,TH$;
 90 A = 3:
    GOSUB 140:
    PRINT @40,TH$
100 PRINT "1                    2                    3";
110 PRINT :
    INPUT "CHOOSE THE TOP OF THE HEAD YOU WANT";A:
    GOSUB 140
120 IF   R = 0 PRINT @480,TH$:
         GOTO 180 ..........................................
130 IF   R = 1 PRINT @500,TH$;:
         GOTO 180 ..........................................
140 IF   A = 1
    THEN TH$ = CHR$ (187) + STRING$ (3,176) + CHR$ (183)

150 IF   A = 2
    THEN TH$ = STRING$ (5,191)
160 IF   A = 3
    THEN TH$ = CHR$ (184) + STRING$ (3,191) + CHR$ (180)

170 RETURN
-------------------------------------------------------------
180 A = 1:
    GOSUB 250:
    PRINT @0,BH$
190 A = 2:
    GOSUB 250:
    PRINT @20,BH$
200 A = 3:
    GOSUB 250:
    PRINT @40,BH$
210 PRINT "1                    2                    3";
220 PRINT :
    INPUT "NOW THE BOTTOM OF HEAD";A:
```

```
     GOSUB 250
230  IF    R = 0 PRINT @544,BH$:
           GOTO 290 ..............................................
240  IF    R = 1 PRINT @564,BH$;:
           GOTO 290 ..............................................
250  IF    A = 1
     THEN  BH$ = CHR$ (139) + CHR$ (189) + CHR$ (191) + CHR$
           (190) + CHR$ (135)
260  IF    A = 2
     THEN  BH$ = CHR$ (191) + CHR$ (189) + CHR$ (191) + CHR$
           (190) + CHR$ (191)
270  IF    A = 3
     THEN  BH$ = CHR$ (171) + CHR$ (189) + CHR$ (191) + CHR$
           (190) + CHR$ (151)
280  RETURN
-------------------------------------------------------------------
290  A = 1:
     GOSUB 370:
     PRINT @0,TB$;
300  A = 2:
     GOSUB 370:
     PRINT @20,TB$;
310  A = 3:
     GOSUB 370:
     PRINT @40,TB$
320  PRINT "1                    2                    3";
330  PRINT :
     INPUT "TOP OF BODY";A:
     GOSUB 370
340  LA$ = CHR$ (191) + STRING$ (2,131):
     RA$ = STRING$ (2,131) + CHR$ (191)
350  IF    R = 0 PRINT @605,LA$ + TB$ + RA$;:
           GOTO 410 ..............................................
360  IF    R = 1 PRINT @625,LA$ + TB$ + RA$;:
           GOTO 410 ..............................................
370  IF    A = 1
     THEN  TB$ = CHR$ (131) + STRING$ (3,191) + CHR$ (131)

380  IF    A = 2
     THEN  TB$ = CHR$ (187) + STRING$ (3,191) + CHR$ (183)

390  IF    A = 3
     THEN  TB$ = CHR$ (131) + CHR$ (187) + CHR$ (191) + CHR$
           (183) + CHR$ (131)
400  RETURN
-------------------------------------------------------------------
410  A = 1:
     GOSUB 480:
     PRINT @0,BB$
420  A = 2:
     GOSUB 480:
```

```
    PRINT @20,BB$
430 A = 3:
    GOSUB 480:
    PRINT @40,BB$
440 PRINT "1                    2                    3";
450 PRINT :
    INPUT "BOTTOM OF BODY";A:
    GOSUB 480
460 IF   R = 0 PRINT @672,BB$:
         GOTO 520 ..........................................
470 IF   R = 1 PRINT @692,BB$;:
         GOTO 520 ..........................................
480 IF   A = 1
    THEN BB$ = STRING$ (5,191)
490 IF   A = 2
    THEN BB$ = CHR$ (174) + STRING$ (3,191) + CHR$ (157)

500 IF   A = 3
    THEN BB$ = CHR$ (190) + STRING$ (3,191) + CHR$ (189)

510 RETURN
-----------------------------------------------------------------
520 L$ = CHR$ (191) + STRING$ (3,128) + CHR$ (191)
530 IF   R = 0 PRINT @736,L$:
         PRINT @800,L$
540 IF   R = 1 PRINT @756,L$;:
         PRINT @820,L$;
550 PRINT @0,"     YOU HAVE JUST BUILT YOUR VERY OWN ROB
    OT!"
560 PRINT :
    PRINT "       "
570 IF   R = 0 PRINT @860,P1$;
580 IF   R = 1 PRINT @880,P2$;
590 FOR  X = 1 TO 5
600      IF   R = 1 SET (107,24):
              SET (110,24)
610      SET (67,24):
         SET (70,24)
620      FOR  Z = 1 TO 500:
         NEXT
630      RESET (67,24):
         RESET (70,24)
640      IF   R = 1 RESET (107,24):
              RESET (110,24)
650      FOR  Z = 1 TO 500:
         NEXT
660 NEXT X
670 PRINT @0,"
          "
680 R = R + 1:
    IF   R = 2
```

```
      THEN 690: .....................................................
      ELSE 70 .....................................................
-------------------------------------------------------------------
  690 GOTO 690
-------------------------------------------------------------------
```

NEWS LETTER Program

The NEWS LETTER program lets you print your own little paper. This program does require a printer. The program enables you to print bold face headings about 3/4 inches high and provides a choice of four different sizes of letters. To jump from large print to regular size, press the (@) key. After running the program, the screen goes blank.

You begin in the large print mode. The spacing of the letters allows room for 13 letters on each line and then spaces down to the next line. Hitting the up arrow key sends the screen contents to the line printer.

One unique idea in this program is the use of variables for more than one purpose. I also try to make double use of control keys for a type of flip-flop control (or back and forth movement) in my programs whenever possible . This makes it easy for the operator to remember, with less chance of hitting the wrong key.

At line 2000 there is a subroutine which copies the screen and send it to your printer. The subroutine scans each screen location, and if it finds a null character, it prints a blank; otherwise, it prints what ever it finds. I like this routine because it dumps the screen in the same size on my printer as it was on the screen.

Operating Commands for NEWSLETTER

```
UP ARROW        =  SEND SCREEN TO PRINTER
@               =  REG. & LARGE PRINT
UP ARROW1       =  SMALL PRINT
UP ARROW2       =  REG. PRINT
UP ARROW3       =  LARGE PRINT
L6              =  6 LINES PER INCH
L8              =  8 LINES PER INCH
C80             =  LINE LENGH
C64             =  LINE LENGH
T5              =  TAB(5)SPACES
;               =  PRINT CHR$(23)
TWO UP ARROWS   =  LINE FEED
```

Figure 4.2 *Newsletter Program*

```
 1 CLEAR 1000
 2 P = 0
10 CLS
50 A3$ = CHR$ (131) + CHR$ (191)
52 A4$ = CHR$ (140) + CHR$ (143) + CHR$ (140)
54 B3$ = STRING$ (2,179) + CHR$ (191)
56 B4$ = CHR$ (143) + STRING$ (2,140)
58 C3$ = STRING$ (2,179) + CHR$ (191)
60 C4$ = STRING$ (2,140) + CHR$ (143)
62 D3$ = CHR$ (191) + CHR$ (176) + CHR$ (191)
64 D4$ = STRING$ (2,128) + CHR$ (143)
66 E3$ = CHR$ (191) + STRING$ (2,179)
68 E4$ = STRING$ (2,140) + CHR$ (143)
70 F3$ = CHR$ (191) + STRING$ (2,179)
72 F4$ = CHR$ (143) + CHR$ (140) + CHR$ (143)
74 G3$ = STRING$ (2,131) + CHR$ (191)
76 G4$ = STRING$ (2,128) + CHR$ (143)
78 H3$ = CHR$ (191) + CHR$ (179) + CHR$ (191)
80 H4$ = CHR$ (143) + CHR$ (140) + CHR$ (143)
82 I3$ = CHR$ (191) + CHR$ (179) + CHR$ (191)
84 I4$ = STRING$ (2,128) + CHR$ (143)
86 J3$ = CHR$ (191) + CHR$ (131) + CHR$ (191)
88 J4$ = CHR$ (143) + CHR$ (140) + CHR$ (143)
90 K3$ = CHR$ (128) + CHR$ (140)
92 K4$ = CHR$ (128) + CHR$ (131)
94 L3$ = STRING$ (3,176)
96 M3$ = CHR$ (140)
97 N3$ = CHR$ (172)
98 O3$ = CHR$ (128) + CHR$ (176) + CHR$ (140)
99 O4$ = CHR$ (131)
100 A1$ = CHR$ (191) + CHR$ (179) + CHR$ (191)
110 A2$ = CHR$ (143) + CHR$ (128) + CHR$ (143)
120 B1$ = CHR$ (191) + CHR$ (179) + CHR$ (159)
130 B2$ = CHR$ (143) + CHR$ (140) + CHR$ (143)
140 C1$ = CHR$ (191) + STRING$ (2,131)
150 C2$ = CHR$ (143) + STRING$ (2,140)
160 D1$ = CHR$ (191) + CHR$ (131) + CHR$ (189)
170 D2$ = CHR$ (143) + CHR$ (140) + CHR$ (131)
180 E1$ = CHR$ (191) + CHR$ (179) + CHR$ (131)
190 E2$ = CHR$ (143) + STRING$ (2,140)
200 F1$ = CHR$ (191) + CHR$ (179) + CHR$ (131)
210 F2$ = CHR$ (143)
220 G1$ = CHR$ (191) + CHR$ (163) + CHR$ (179)
230 G2$ = CHR$ (143) + CHR$ (140) + CHR$ (143)
240 H1$ = CHR$ (191) + CHR$ (176) + CHR$ (191)
250 H2$ = CHR$ (143) + CHR$ (128) + CHR$ (143)
260 I1$ = CHR$ (131) + CHR$ (191) + CHR$ (131)
270 I2$ = CHR$ (140) + CHR$ (143) + CHR$ (140)
280 J1$ = CHR$ (131) + CHR$ (191) + CHR$ (131)
290 J2$ = CHR$ (140) + CHR$ (143)
```

```
300 K1$ = CHR$ (191) + CHR$ (184) + CHR$ (143)
310 K2$ = CHR$ (143) + CHR$ (130) + CHR$ (143)
320 L1$ = CHR$ (191)
330 L2$ = CHR$ (143) + STRING$ (2,140)
340 M1$ = CHR$ (159) + CHR$ (188) + CHR$ (175)
350 M2$ = CHR$ (143) + CHR$ (128) + CHR$ (143)
360 N1$ = CHR$ (191) + CHR$ (181) + CHR$ (191)
370 N2$ = CHR$ (143) + CHR$ (138) + CHR$ (143)
380 O1$ = CHR$ (191) + CHR$ (131) + CHR$ (191)
390 O2$ = CHR$ (143) + CHR$ (140) + CHR$ (143)
400 P1$ = CHR$ (191) + CHR$ (179) + CHR$ (191)
410 P2$ = CHR$ (143)
420 Q1$ = CHR$ (191) + CHR$ (131) + CHR$ (149)
430 Q2$ = CHR$ (143) + CHR$ (142) + CHR$ (141)
440 R1$ = CHR$ (191) + CHR$ (179) + CHR$ (191)
450 R2$ = CHR$ (143) + CHR$ (131) + CHR$ (141)
460 S1$ = CHR$ (191) + STRING$ (2,179)
470 S2$ = STRING$ (2,140) + CHR$ (143)
480 T1$ = CHR$ (131) + CHR$ (191) + CHR$ (131)
490 T2$ = CHR$ (128) + CHR$ (143)
500 U1$ = CHR$ (191) + CHR$ (128) + CHR$ (191)
510 U2$ = CHR$ (143) + CHR$ (140) + CHR$ (143)
520 V1$ = CHR$ (191) + CHR$ (128) + CHR$ (191)
530 V2$ = CHR$ (139) + CHR$ (140) + CHR$ (135)
540 W1$ = CHR$ (159) + CHR$ (176) + CHR$ (175)
550 W2$ = CHR$ (143) + CHR$ (131) + CHR$ (143)
560 X1$ = CHR$ (143) + CHR$ (176) + CHR$ (143)
570 X2$ = CHR$ (143) + CHR$ (128) + CHR$ (143)
580 Y1$ = CHR$ (191) + CHR$ (128) + CHR$ (191)
590 Y2$ = CHR$ (128) + CHR$ (143)
600 Z1$ = CHR$ (131) + CHR$ (179) + CHR$ (143)
610 Z2$ = CHR$ (143) + STRING$ (2,140)
690 A$ = INKEY$
692 IF   A$ = " "P = P + 5:
         X = X + 1
695 IF   X = 13P = P + 63:
         X = 0
700 IF   A$ = "A" PRINT @P,A1$;:
         PRINT @P + 64,A2$;:
         P = P + 5:
         X = X + 1
710 IF   A$ = "B" PRINT @P,B1$;:
         PRINT @P + 64,B2$;:
         P = P + 5:
         X = X + 1
720 IF   A$ = "C" PRINT @P,C1$;:
         PRINT @P + 64,C2$;:
         P = P + 5:
         X = X + 1
730 IF   A$ = "D" PRINT @P,D1$;:
         PRINT @P + 64,D2$;:
```

```
            P = P + 5:
            X = X + 1
740 IF      A$ = "E" PRINT @P,E1$;:
            PRINT @P + 64,E2$;:
            P = P + 5:
            X = X + 1
750 IF      A$ = "F" PRINT @P,F1$;:
            PRINT @P + 64,F2$;:
            P = P + 5:
            X = X + 1
760 IF      A$ = "G" PRINT @P,G1$;:
            PRINT @P + 64,G2$;:
            P = P + 5:
            X = X + 1
770 IF      A$ = "H" PRINT @P,H1$;:
            PRINT @P + 64,H2$;:
            P = P + 5:
            X = X + 1
780 IF      A$ = "I" PRINT @P,I1$;:
            PRINT @P + 64,I2$;:
            P = P + 5:
            X = X + 1
790 IF      A$ = "J" PRINT @P,J1$;:
            PRINT @P + 64,J2$;:
            P = P + 5:
            X = X + 1
800 IF      A$ = "K" PRINT @P,K1$;:
            PRINT @P + 64,K2$;:
            P = P + 5:
            X = X + 1
810 IF      A$ = "L" PRINT @P,L1$;:
            PRINT @P + 64,L2$;:
            P = P + 5:
            X = X + 1
820 IF      A$ = "M" PRINT @P,M1$;:
            PRINT @P + 64,M2$;:
            P = P + 5:
            X = X + 1
830 IF      A$ = "N" PRINT @P,N1$;:
            PRINT @P + 64,N2$;:
            P = P + 5:
            X = X + 1
840 IF      A$ = "O" PRINT @P,O1$;:
            PRINT @P + 64,O2$;:
            P = P + 5:
            X = X + 1
850 IF      A$ = "P" PRINT @P,P1$;:
            PRINT @P + 64,P2$;:
            P = P + 5:
            X = X + 1
860 IF      A$ = "Q" PRINT @P,Q1$;:
```

```
            PRINT @P + 64,Q2$;:
            P = P + 5:
            X = X + 1
 870 IF     A$ = "R" PRINT @P,R1$;:
            PRINT @P + 64,R2$;:
            P = P + 5:
            X = X + 1
 880 IF     A$ = "S" PRINT @P,S1$;:
            PRINT @P + 64,S2$;:
            P = P + 5:
            X = X + 1
 890 IF     A$ = "T" PRINT @P,T1$;:
            PRINT @P + 64,T2$;:
            P = P + 5:
            X = X + 1
 900 IF     A$ = "U" PRINT @P,U1$;:
            PRINT @P + 64,U2$;:
            P = P + 5:
            X = X + 1
 910 IF     A$ = "V" PRINT @P,V1$;:
            PRINT @P + 64,V2$;:
            P = P + 5:
            X = X + 1
 920 IF     A$ = "W" PRINT @P,W1$;:
            PRINT @P + 64,W2$;:
            P = P + 5:
            X = X + 1
 930 IF     A$ = "X" PRINT @P,X1$;:
            PRINT @P + 64,X2$;:
            P = P + 5:
            X = X + 1
 940 IF     A$ = "Y" PRINT @P,Y1$;:
            PRINT @P + 64,Y2$;:
            P = P + 5:
            X = X + 1
 950 IF     A$ = "Z" PRINT @P,Z1$;:
            PRINT @P + 64,Z2$;:
            P = P + 5:
            X = X + 1
 960 IF     A$ = "[" GOTO 2000 ..................................
 970 IF     A$ = "@"
     THEN 3000 ..................................................
 980 IF     A$ = ";" PRINT CHR$ (23)
1000 IF     A$ = "1" PRINT @P,A3$;:
            PRINT @P + 64,A4$;:
            P = P + 5:
            X = X + 1
1010 IF     A$ = "2" PRINT @P,B3$;:
            PRINT @P + 64,B4$;:
            P = P + 5:
            X = X + 1
```

```
1020 IF   A$ = "3" PRINT @P,C3$;:
          PRINT @P + 64,C4$;:
          P = P + 5:
          X = X + 1
1030 IF   A$ = "4" PRINT @P,D3$;:
          PRINT @P + 64,D4$;:
          P = P + 5:
          X = X + 1
1040 IF   A$ = "5" PRINT @P,E3$;:
          PRINT @P + 64,E4$;:
          P = P + 5:
          X = X + 1
1050 IF   A$ = "6" PRINT @P,F3$;:
          PRINT @P + 64,F4$;:
          P = P + 5:
          X = X + 1
1060 IF   A$ = "7" PRINT @P,G3$;:
          PRINT @P + 64,G4$;:
          P = P + 5:
          X = X + 1
1070 IF   A$ = "8" PRINT @P,H3$;:
          PRINT @P + 64,H4$;:
          P = P + 5:
          X = X + 1
1080 IF   A$ = "9" PRINT @P,I3$;:
          PRINT @P + 64,I4$;:
          P = P + 5:
          X = X + 1
1090 IF   A$ = "0" PRINT @P,J3$;:
          PRINT @P + 64,J4$;:
          P = P + 5:
          X = X + 1
1100 IF   A$ = ":" PRINT @P,K3$;:
          PRINT @P + 64,K4$;:
          P = P + 5:
          X = X + 1
1110 IF   A$ = "-" PRINT @P,L3$;:
          P = P + 5:
          X = X + 1
1120 IF   A$ = "." PRINT @P + 64,M3$;:
          P = P + 5:
          X = X + 1
1130 IF   A$ = "," PRINT @P + 64,N3$;:
          P = P + 5:
          X = X + 1
1140 IF   A$ = "/" PRINT @P,O3$;:
          PRINT @P + 64,O4$;:
          P = P + 5:
          X = X + 1
1150 GOTO 690
```

```
2000 CLEAR 1000:
     LPRINT CHR$ (29):
     LPRINT CHR$ (27); CHR$ (56)
2010 FOR  Y = 0 TO 47
2020      P$ = ""
2030      FOR  X = 0 TO 127
2040           IF   POINT (X,Y)
               THEN P$ = P$ + CHR$ (191):
               ELSE P$ = P$ + " "
2050      NEXT X
2060      LPRINT P$
2070 NEXT Y
2080 GOTO 690
```

```
3000 INPUT A$
3010 IF   A$ = "@"
     THEN 690 .....................................................
3015 IF   A$ = "-" PRINT CHR$ (23)
3030 IF   A$ = "[1" LPRINT CHR$ (29):
          GOTO 3000 ...............................................
3040 IF   A$ = "[2" LPRINT CHR$ (30):
          GOTO 3000 ...............................................
3050 IF   A$ = "[3" LPRINT CHR$ (31):
          GOTO 3000 ...............................................
3060 IF   A$ = "[" LPRINT " ":
          GOTO 3000 ...............................................
3070 IF   A$ = "L6" LPRINT CHR$ (27); CHR$ (54):
          GOTO 3000 ...............................................
3080 IF   A$ = "L8" LPRINT CHR$ (27); CHR$ (56):
          GOTO 3000 ...............................................
3090 IF   A$ = "C80" LPRINT CHR$ (27); CHR$ (65):
          GOTO 3000 ...............................................
3100 IF   A$ = "C64" LPRINT CHR$ (27); CHR$ (66):
          GOTO 3000 ...............................................
3110 IF   A$ = "T5" INPUT A$:
          LPRINT TAB( 5)A$:
          GOTO 3000 ...............................................
3120 LPRINT A$
3200 GOTO 3000
```

5

Methods of Display Using SET/RESET

The SET/RESET command can be used for slowing down certain graphics for a smoother-looking effect, as shown in the SLOT MACHINE and the SHOOTING COWBOY programs.

SLOT MACHINE

This game was the first I wrote after unpacking my computer and learning what RUN, LIST, END, etc. stood for.

I should take a moment to thank a young boy who helped me with a part of this program. At the time, I was lost in finding a way to randomly select the cherry, bar and apple. Then I met this young boy in our local computer store. He must have been about 12 to 15 years old. Well, I mentioned the problem I was having, and he just smiled at me, sat down with a piece of paper and pencil, and in about 30 seconds he wrote out the entire routine for selecting the random combinations. He said he was not old enough to have his own computer, so he just played with the store's machine. I never did get his name.

SLOT MACHINE starts by asking how much money you want to play with. Then it draws graphics on the screen and plays your first coin. All bets are 50 cents, and the jackpot is $3.00, — not quite as much fun as Las Vegas, but it won't cost you as much either!

The important thing to note in this program is the animation for the arm movement. This is really an eye-trick which makes the arm appear to be turning around, while the routine is actually drawing only one line and then reseting the line and drawing another one.

One of the members of our computer club thought I used machine-language for the arm! BASIC can be fast, — it's just a matter of using it to best advantage to get the effects you want.

Figure 5.1 *Slot Machine Program*

```
 10 CLS
 20 PRINT CHR$ (23)
 30 PRINT @460,"SLOT MACHINE":
    FOR  X = 1 TO 1000:
    NEXT
 40 PRINT @452,"WRITTEN BY TOM DEMPSEY":
    FOR  X = 1 TO 1000:
    NEXT :
    CLS
 50 PRINT "THIS IS A 50 CENT SLOT MACHINE/WITH SOUND."
 60 PRINT "JACKPOT IS $3.00 FOR 3 OF A KIND."
 70 PRINT "HOW MANY 50 CENT PIECES DO YOU WANT TO START
    WITH";
 80 INPUT M
 90 LET M = M * .5
100 PRINT "YOU ARE STARTING WITH $";M
110 FOR  X = 1 TO 1000
120 NEXT X:
    CLS
130 PRINT @273,"                                ";
140 PRINT @272," ";
150 LET C = 0
160 LET L = 0
170 LET O = 0
180 FOR  R = 90 TO 95:
         SET (R,20):
    NEXT
190 FOR  R = 30 TO 90:
         SET (R,10):
    NEXT
200 FOR  R = 30 TO 90:
         SET (R,17):
    NEXT :
    FOR  R = 30 TO 90:
         SET (R,41):
    NEXT
210 FOR  R = 10 TO 41:
         SET (30,R):
    NEXT :
    FOR  R = 10 TO 41:
         SET (90,R):
    NEXT
220 FOR  R = 30 TO 90:
         SET (R,35):
    NEXT :
    FOR  R = 10 TO 20:
         SET (95,R):
    NEXT
230 FOR  R = 10 TO 20:
         RESET (95,R):
```

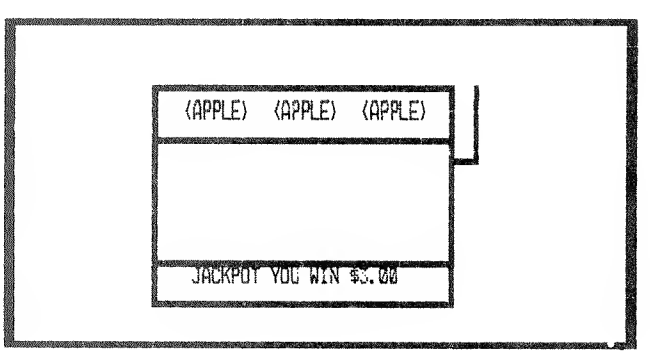
```
     NEXT :
     FOR  R = 20 TO 40:
          SET (95,R):
     NEXT
 240 FOR  R = 40 TO 20 STEP - 1:
          RESET (95,R):
     NEXT
 250 FOR  R = 20 TO 10 STEP - 1:
          SET (95,R):
     NEXT
 260 LET B = 0:
     GOTO 290
-------------------------------------------------------------------
 270 LET B = 1:
     GOTO 290
-------------------------------------------------------------------
 280 LET B = 2:
     GOTO 290
-------------------------------------------------------------------
 290 N = RND (3)
 300 IF   N = 1
     THEN 330 ..................................................
 310 IF   N = 2
     THEN 380 ..................................................
 320 IF   N = 3
     THEN 430 ..................................................
 330 FOR  X = 1 TO 500
 340 NEXT X
 350 PRINT " <LEMON> ";:
     FOR  X = 1 TO 10:
          OUT 255,1:
          OUT 255,2:
     NEXT
 360 LET C = C + 1
 370 GOTO 480
-------------------------------------------------------------------
 380 FOR  X = 1 TO 500
 390 NEXT X
 400 PRINT " <APPLE> ";:
     FOR  X = 1 TO 10:
          OUT 255,1:
          OUT 255,2:
     NEXT
 410 LET L = L + 1
 420 GOTO 480
-------------------------------------------------------------------
 430 FOR  X = 1 TO 500
 440 NEXT X
 450 PRINT " <*****> ";:
     FOR  X = 1 TO 10:
          OUT 255,1:
```

```
          OUT 255,2:
     NEXT
460  LET O = O + 1
470  GOTO 480
```

```
480  IF   B = 0
     THEN 270 ..................................................
490  IF   B = 1
     THEN 280 ..................................................
500  IF   C = 3
     THEN 560 ..................................................
510  IF   L = 3
     THEN 560 ..................................................
520  IF   O = 3
     THEN 560 ..................................................
530  LET M = M - .5
540  IF   M = 0
     THEN 630 ..................................................
550  GOTO 600
```

```
560  FOR  X = 1 TO 100:
          OUT 255,1:
          OUT 255,2:
          PRINT @787,"JACKPOT YOU WIN $3.00";:
     NEXT X
570  FOR  X = 1 TO 1000:
     NEXT
580  PRINT @787,"                          ";
590  LET M = M + 3
600  PRINT @0,"YOU HAVE $";M;" TO PLAY AGAIN HIT ENTER";
610  INPUT A$:
     PRINT @15,"                            ";
620  GOTO 130
```

```
630  PRINT @0,"YOU HAVE LOST ALL YOUR MONEY....PLAY AGAIN
      SOON"
```



Program Explanation

Lines 10 to 70 print the rules.
Lines 80 to 100 change the coins to dollars.
Lines 110 to 250 move the arm.
Lines 260 to 280 keep the program from repeating.
Lines 300 to 470 generate random selection and sound.
Lines 480 to 520 provide program control.
Lines 560 to 570 print jackpot.
Lines 580 to 630 keep track of wins and end game.

SHOOTING COWBOY

The following program is called SHOOTING COWBOY. It is another example of using SET and RESET.

This program uses the famous FOR NEXT commands for the graphics. I originally thought they would be too slow for the animation but was surprised at how fast they are in this program. This program was originally written for a Level I TRS-80 and later changed to Level II.

After entering RUN, the program starts out by drawing a town, — or is it a city? I guess the difference depends on the population. Then the cowboy is placed on the screen, and the targets start falling.

You shoot at the targets by hitting the up-arrow, — please don't hit it *too* hard. You get 50 shots. The player to hit the most targets with 50 shots wins the game.

In this program, we use the random number to draw our picture of the town. This saves a lot of programming, and it can also be used for POKEing the graphics on the screen for even greater speed.

One thing you should note in line 360 is that we check for the shot being fired right after SETting the target. This is done so that the target will be shown at the same time as the shot.

The animation is no more than we need to give the effects we want. Keep it simple but effective. The lower part of the arm from the elbow down is all we have to move to fire the gun and get the effects we need. The SET, RESET and FOR NEXT statements are plenty fast for this amount of animation.

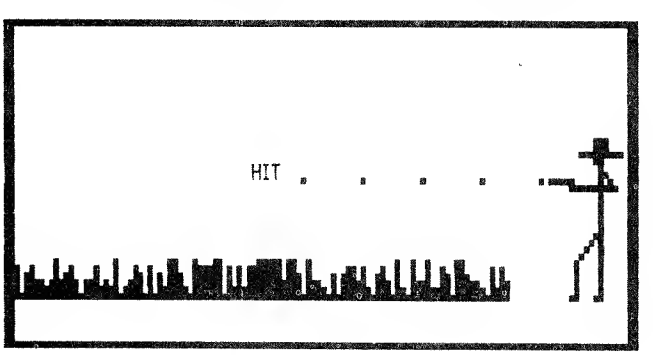


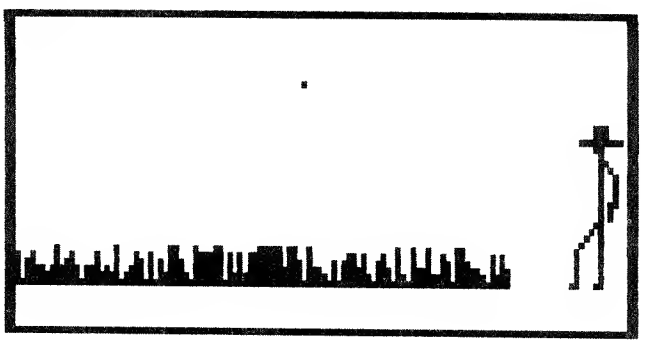
Figure 5.2 *Shooting Cowboy Program*

```
100 CLS :
    PRINT "TEST YOUR QUICK DRAW : SEE HOW MANY TARGETS Y
    OU"
110 PRINT "CAN HIT WITH 50 SHOTS. TO SHOOT, HIT THE ([)
    ARROW"
120 FOR  X = 1 TO 3000:
    NEXT X:
    CLS
130 LET T = 0:
    LET S = 0
140 IF    (M = 60) + (L = 23) LET T = T + 1:
          PRINT @0,"SCORE=";T:
          FOR  X = 1 TO 500:
               NEXT X
150       A = RND (40):
          IF   A < 35
          THEN 150 ..........................................
160       FOR  M = A TO 40:
               SET (B,M):
          NEXT
170       A = RND (40):
          IF   A < 35
          THEN 170 ..........................................
180       IF   B > 100
          THEN 190: .........................................
          ELSE B = B + 1:
               GOTO 160 .....................................
-------------------------------------------------------------
190       FOR  M = 116 TO 124:
               SET (M,19):
          NEXT M
200       FOR  M = 119 TO 121:
               SET (M,17):
          NEXT M
210       FOR  M = 119 TO 121:
               SET (M,18):
          NEXT M
220       SET (119,20)
230       FOR  M = 20 TO 40:
               SET (120,M):
          NEXT M
240       FOR  M = 35 TO 40:
               SET (115,M):
          NEXT M
250       SET (119,31):
          SET (118,32):
          SET (117,33):
          SET (116,34)
260       SET (114,40):
          SET (119,40)
```

```
270       SET (121,22):
          SET (122,23):
          SET (123,24)
280       SET (123,25):
          SET (123,26):
          SET (123,27):
          SET (123,28)
290       SET (122,28):
          SET (122,29):
          SET (122,30)
300       FOR  M = 108 TO 60 STEP - 12:
               RESET (M,23):
          NEXT
310       FOR  M = 122 TO 114 STEP - 1:
               RESET (M,24):
          NEXT
320       FOR  M = 115 TO 110 STEP - 1:
               RESET (M,23):
          NEXT
330       SET (120,24)
340       REM  DROP THE TARGET
350       LET L = 2
360       SET (60,L):
          Y$ = INKEY$ :
          IF   Y$ = "["
          THEN 410 ..........................................
370       RESET (60,L)
380       LET L = L + 3
390       IF   L = 47
          THEN 350 ..........................................
400       GOTO 360 ..........................................
-------------------------------------------------------------
410       REM  SHOTS GUN
420       FOR  X = 1 TO 10:
               OUT 255,1:
               OUT 255,2:
          NEXT
430       LET S = S + 1
440       IF   S = 50 PRINT @0,"END OF GAME.....YOUR SCOR
               E IS";T:
               GOTO 600 ..................................
450       RESET (123,25):
          RESET (123,26):
          RESET (123,27):
          RESET (123,28)
460       RESET (122,28):
          RESET (122,29):
          RESET (122,30)
470       FOR  M = 122 TO 114 STEP - 1:
               SET (M,24):
          NEXT M
```

```
480       FOR  M = 114 TO 110 STEP - 1:
               SET (M,23):
          NEXT M
490       FOR  M = 108 TO 60 STEP - 12:
               SET (M,23):
          NEXT M
500       IF   (L = 23) + (M = 60) PRINT @448, TAB( 25);"
               HIT";:
               FOR  X = 1 TO 500:
                    NEXT X:
                    PRINT @448, TAB( 25);"    ";:
                    GOTO 140 ..................................
510            FOR  M = 108 TO 60 STEP - 12:
                    RESET (M,23):
               NEXT M
520            FOR  M = 122 TO 114 STEP - 1:
                    RESET (M,24):
               NEXT M
530            FOR  M = 114 TO 110 STEP - 1:
                    RESET (M,23):
               NEXT M
540            SET (120,24)
550            FOR  M = 25 TO 28:
                    SET (123,M):
               NEXT M
560            FOR  M = 28 TO 30:
                    SET (122,M):
               NEXT M
570            GOTO 370 ..................................
-------------------------------------------------------------
600            C$ = CHR$ (191)
610            PRINT @384,C$;:
               FOR  X = 1 TO 15:
                    PRINT C$;:
               NEXT
620            FOR  X = 1 TO 500:
               NEXT
630            PRINT @398, CHR$ (128) + CHR$ (128);
635            FOR  X = 1 TO 500:
               NEXT
640            PRINT @398,C$ + C$;
650            I$ = CHR$ (140)
660            A = 400
670            PRINT @A,I$;
675            PRINT @A, CHR$ (128);
680            A = A + 1:
               IF   A > 447
               THEN 700 ..................................
690            GOTO 670 ..................................
-------------------------------------------------------------
700            PRINT @379,"    ";
```

```
 710            PRINT @1020, CHR$ (131) + CHR$ (191) + CHR$
                (131);
1000            GOTO @b``` ....................................
```



Program Explanation

Lines 10 to 20 print instructions.
Line 30 starts timer and clears screen.
Line 40 sets T and S at 0.
Line 50 checks for hit; changes score.
Lines 60 to 90 draw the town.
Lines 100 to 240 draw the cowboy.
Lines 250 to 310 drop the target.
Lines 320 to 480 sound and animation
Lines 490 to 630 surprise ending.

NOTES

6

Methods of Display Using FOR NEXT

The best method of speeding up our SET and RESET commands is the FOR NEXT loop. The following programs, called TANK CHASE, TWITS, and HORSE RACE are very fast, — especially for using only SET/RESET.

TANK CHASE

TANK CHASE is one of the harder games to play. It's a game that starts out easy, but the longer you play, the harder it gets! This makes for a very challenging game. Once you start playing, you can't stop.

The object is to hit a target on the screen with your tank, which never stops moving. Each time you miss the target it becomes harder to hit. Play the game and you'll see what I mean. The up-arrow key controls all your turns, and even when you can no longer see the target, the computer knows where it is, — so keep trying!

One interesting change would be to let another player control a moving target.

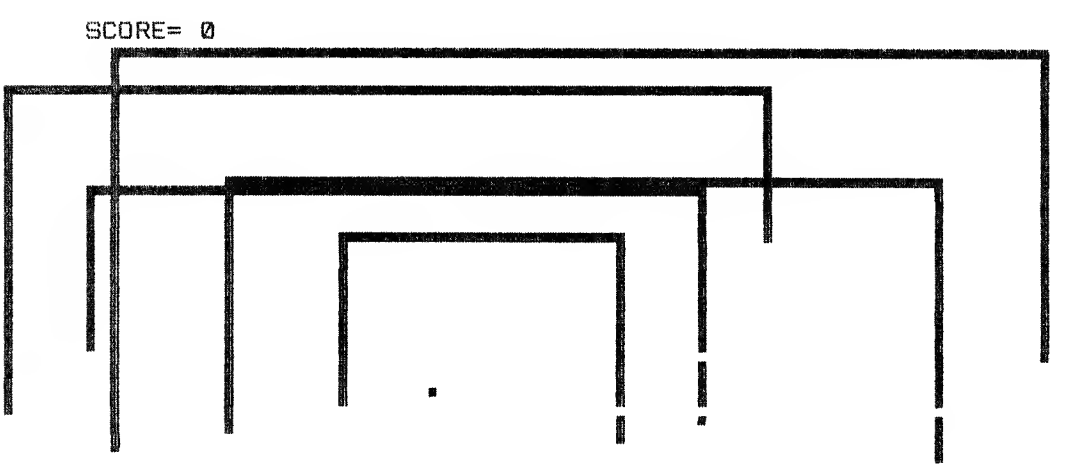


Figure 6.1 *Tank Chase Program*

```
10 T = 0:
   P = 0
20 CLS
30 PRINT "THIS GAME IS CALLED TANK CHASE....TO TURN YOU
   R TANK"
40 PRINT "HIT THE ([) ARROW. EACH TIME YOU HIT THE TARG
   ET YOU"
50 PRINT "GET 5 POINTS. YOU CAN ONLY HIT THE TARGET GOI
   NG IN"
60 PRINT "THIS ---> DIRECTION. EACH TIME YOU MISS THE T
   ARGET"
70 PRINT "THE GAME GETS HARDER TO PLAY AS YOU WILL SOON
    SEE!!"
80 PRINT :
   PRINT "WHEN READY HIT ENTER";:
   INPUT A$
90 CLS
100 PRINT @5,"SCORE=";T;:
    PRINT @0," ";
110 A$ = "["
120 C = RND (127):
    D = RND (47)
130 IF   D < 10 GOTO 120 ....................................
140 SET (C,D)
150 A = 63:
    B = 23
160 RESET (A,B)
170 LET A = A + 1
180 IF   INKEY$ = "["
    THEN 230 ................................................
190 IF   POINT (C,D) = 0 LET T = T + 5:
         GOTO 90 ............................................
200 SET (A,B)
210 IF   A = 127 GOTO 230 ...................................
220 GOTO 160
-----------------------------------------------------------------
230 SET (A,B)
240 IF   B = 3 GOTO 280 .....................................
250 LET B = B - 1
260 IF   INKEY$ = "["
    THEN 280 ................................................
270 GOTO 230
-----------------------------------------------------------------
280 SET (A,B)
290 IF   A = 0 GOTO 330 .....................................
300 LET A = A - 1
310 IF   INKEY$ = "["
    THEN 330 ................................................
320 GOTO 280
-----------------------------------------------------------------
```

```
330 SET (A,B)
340 IF   B = 47 GOTO 380 ....................................
350 LET B = B + 1
360 IF   INKEY$ = "["
    THEN 380 ................................................
370 GOTO 330
-------------------------------------------------------------
380 LET P = P + 1
390 IF   P = 20 GOTO 410 ....................................
400 GOTO 160
-------------------------------------------------------------
410 PRINT @409,"END OF GAME":
    END
-------------------------------------------------------------
```

Program Explanation

Lines 10 to 90 print the rules.
Lines 110 to 170 start the tank moving and set target.
Lines 180 to 410 check if player turns tank.
Lines 380 to 390 are a counter for number of turns made.

TWITS IN WATER

This program was written in order to show my son a graphic example of the random number generator. I try to put some kind of graphics into every program I write.

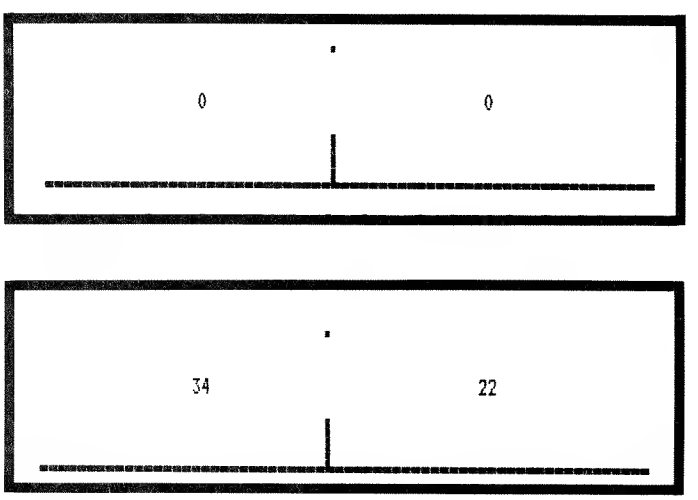


Figure 6.2 *Twits Program*

```
 10 REM  *** TWITS IN WATER
 20 REM  *** WRITTEN BY TOM DEMPSEY
 30 CLS
 40 PRINT "THIS IS A GRAPHIC DISPLAY OF THE COMPUTER'S R
    ANDOM"
 50 PRINT "NUMBER GENERATOR."
 60 PRINT "I NAMED IT TWITS IN WATER BECAUSE A TWIT IS"
 70 PRINT "SOMETHING NO ONE NEEDS."
 80 PRINT "PICTURE YOURSELF AS A BIG GIANT, STANDING OVE
    R A RIVER,"
 90 PRINT "DROPPING TWITS INTO THE WATER. TO MAKE IT MOR
    E"
100 PRINT "INTERESTING, YOU DROP THEM ON TOP OF A WALL T
    O SEE"
110 PRINT "HOW MANY FALL ON EACH SIDE.":
    PRINT :
    PRINT "WHEN READY TO WATCH, HIT ENTER";:
    INPUT A$
120 CLS
130 FOR  M = 30 TO 40:
         SET (60,M):
    NEXT
140 FOR  M = 0 TO 127:
         SET (M,40):
    NEXT
150 PRINT @576, TAB( 15);B; TAB( 45);A
160 SET (60,T):
    FOR  X = 1 TO 50:
    NEXT :
    RESET (60,T)
170 IF   T > 30 LET T = 0:
         GOTO 190 ..........................................
180 T = T + 4:
    GOTO 160
-------------------------------------------------------------
190 N = RND (2)
200 IF   N = 1
    THEN 220 ..............................................
210 IF   N = 2
    THEN 280 ..............................................
220 SET (64,32):
    FOR  X = 1 TO 50:
    NEXT :
    RESET (64,32)
230 SET (67,35):
    FOR  X = 1 TO 50:
    NEXT :
    RESET (67,35)
240 SET (70,38):
    FOR  X = 1 TO 50:
```

```
     NEXT :
     RESET (70,38)
 250 RESET (73,40):
     SET (73,40)
 260 A = A + 1
 270 GOTO 150
```

```
 280 SET (56,32):
     FOR  X = 1 TO 50:
     NEXT :
     RESET (56,32)
 290 SET (53,35):
     FOR  X = 1 TO 50:
     NEXT :
     RESET (53,35)
 300 SET (50,38):
     FOR  X = 1 TO 50:
     NEXT :
     RESET (50,38)
 310 RESET (47,40):
     SET (47,40)
 320 B = B + 1
 330 GOTO 150
```

Program Explanation

Lines 10 to 120 are the instructions.
Lines 130 to 140 draw the wall and water.
Line 150 keeps the score.
Lines 160 to 330 drop the twits.

I sure hope there are no spelling errors in this program!

HORSE RACE

This is a good game for a house full of company. We tried it one night on some friends, and all the laughter and yelling of ten people for their horse to come in first was something else! The game is played by placing your bets in a kitty and letting the winner take all. Of course, real gambling is not legal, so we use buttons, — Ha! Ha!

The game shows the horses running and also prints out the win, place and show, — so there's no mistaking who wins!

Figure 6.3 *Horse Race Program*

```
 10 CLS
 20 FOR  N = 1 TO 9
 30      PRINT N
 40 NEXT N
 50 FOR  M = 0 TO 26:
         SET (127,M):
    NEXT
 60 A = 5:
    B = 5:
    C = 5:
    D = 5:
    E = 5:
    F = 5:
    G = 5:
    H = 5:
    I = 5
 70 SET (A,1)
 80 SET (B,4)
 90 SET (C,7)
100 SET (D,10)
110 SET (E,13)
120 SET (F,16)
130 SET (G,19)
140 SET (H,22)
150 SET (I,25)
160 PRINT @640,"WELCOME TO THE RACES":
    FOR  X = 1 TO 2000:
    NEXT
170 PRINT @640,"PLEASE PLACE YOUR BETS":
    FOR  X = 1 TO 2000:
    NEXT
180 PRINT @640,"WHEN READY TO PLAY HIT (Y)"
190 A$ = INKEY$
200 IF   A$ = "Y"
    THEN 220 ..................................................
210 GOTO 190
-------------------------------------------------------------------
220 PRINT @640,"
    "
230 PRINT @640,"THE HORSES ARE AT THE POST":
    FOR  X = 1 TO 2000:
    NEXT
240 PRINT @640,"*** THEY'RE OFF AND RUNNING ***"
250 R = RND (9):
    IF   R > 9
    THEN 250 ..................................................
260 IF   R = 1 RESET (A,1):
         A = A + 1:
         SET (A,1)
270 IF   R = 2 RESET (B,4):
```

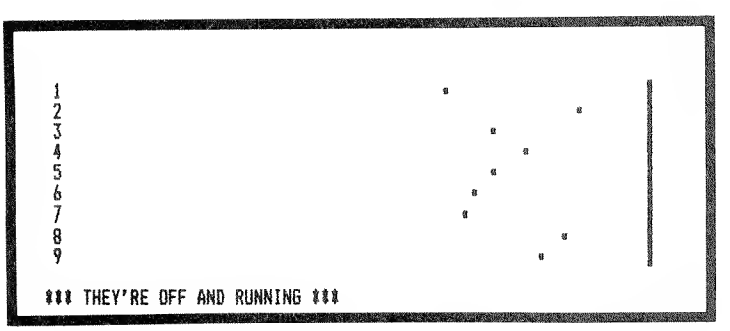
```
            B = B + 1:
            SET (B,4)
280 IF      R = 3 RESET (C,7):
            C = C + 1:
            SET (C,7)
290 IF      R = 4 RESET (D,10):
            D = D + 1:
            SET (D,10)
300 IF      R = 5 RESET (E,13):
            E = E + 1:
            SET (E,13)
310 IF      R = 6 RESET (F,16):
            F = F + 1:
            SET (F,16)
320 IF      R = 7 RESET (G,19):
            G = G + 1:
            SET (G,19)
330 IF      R = 8 RESET (H,22):
            H = H + 1:
            SET (H,22)
340 IF      R = 9 RESET (I,25):
            I = I + 1:
            SET (I,25)
350 IF      A = 127 LET Z = Z + 1:
            A = 1:
            Y = A:
            GOTO 450 ..........................................
360 IF      B = 127 LET Z = Z + 1:
            B = 2:
            Y = B:
            GOTO 450 ..........................................
370 IF      C = 127 LET Z = Z + 1:
            C = 3:
            Y = C:
            GOTO 450 ..........................................
380 IF      D = 127 LET Z = Z + 1:
            D = 4:
            Y = D:
            GOTO 450 ..........................................
390 IF      E = 127 LET Z = Z + 1:
            E = 5:
            Y = E:
            GOTO 450 ..........................................
400 IF      F = 127 LET Z = Z + 1:
            F = 6:
            Y = F:
            GOTO 450 ..........................................
410 IF      G = 127 LET Z = Z + 1:
            G = 7:
            Y = F:
            GOTO 450 ..........................................
```

```
420 IF    H = 127 LET Z = Z + 1:
          H = 8:
          Y = H:
          GOTO 450 ..............................................
430 IF    I = 127 LET Z = Z + 1:
          I = 9:
          Y = I:
          GOTO 450 ..............................................
440 GOTO 250
-------------------------------------------------------------------
450 IF    Z = 1 PRINT @704,"WIN  ";Y
460 IF    Z = 2 PRINT @768,"PLACE";Y
470 IF    Z = 3 PRINT @832,"SHOW ";Y
480 IF    Z = 3 END  ............................................
490 GOTO 250
-------------------------------------------------------------------
```

Program Explanation

Line 20 prints the post positions.
Line 50 draws the finish line.
Lines 60 to 150 set the horses at the post.
Lines 160 to 250 start the race.
Lines 260 to 430 advance the horses using RND.
Lines 450 to 490 print the winners.

My wife says this program looks more like a turtle race, so you might want to speed it up. I prefer the suspense of a long race. I must admit the horses do take some imagination.



RACETRAC

This program enables you to keep track of the jockeys' past records, the best post positions, and the average winning weight. You can compile these statistics for as long as you want. Once this information is saved, let the computer pick the winners.

You can play the computer's selections any way you wish. I tried this out last season and showed about an 80% prediction accuracy. The program picked a horse in the money about 7 out of 9 races for each day. I can only afford to place $2.00 bets, but I still showed a profit of $30 to $40.00 per day! How well it works depends on how you play the computer selections.

Once the computer picked the winner of every race, but I had stayed at home that day! @*@%@%@$%! If I had bet that day, I would have won over $1000.00 using only $2.00 bets!

I learned some interesting statistics last season. The winners of most races were in post positions 1, 2, 4 or 5, with number 3 horse getting squeezed out by the number 4 and 5 horses trying to get closer to the rail. Also, the best weight showed to be between 114 and 116.

There are many things that have not been taken into consideration, such as how the horse feels, how badly the jockey wants to win a race or whether he's just out to get ready for a bigger race later in the season. This program still helps make your choice a lot easier and may even help you retire sooner than you think!

Operating Instructions

After loading the program, the first thing you must do is enter a list of jockeys' names for the computer data file. This enables you to customize the program for the area in which you live or for a special track at which you like to play.

Below is an example of how this should look on your screen.

```
A = PINCAY
B = OLIVARES
C = TORO
```

The limit is 15 jockeys. The reason you insert letters in front of each jockey is for ease of data entry later on. You must remember to use the *down arrow* after each name instead of the enter key. After the complete list is typed, press enter, and your complete list will be contained in A$.

The program next goes to the menu and asks for your selection. At this time, I suggest that you prepare a blank tape to save data so you can be sure of having the list of jockeys on tape in case you're not going to enter any more race data at this time.

Be sure the record keys are pressed on the recorder before you enter a 5 to save data. There is a change you might like to add to the program. If you call for the computer to list all data and you have not entered any racing data, you will crash

the program and get a 0/ERROR in line 3060. To eliminate this, change line 3000 to read:

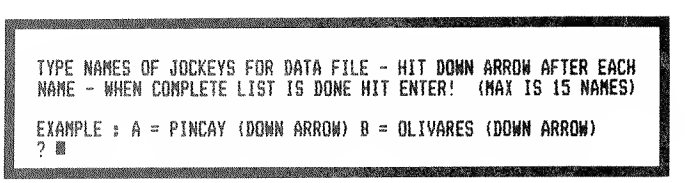
```
3000 CLS:ON ERROR GOTO 10
```

This was not done in my original program because I didn't think anyone would ask to see data if they hadn't put any in, but after making this mistake, I thought it best to add the error trap!

Another tip to help out is to make a list of the jockeys on paper. Because of space limitations, it wasn't practical to put all this on the screen for every mode. This program was written to allow changes to be made very easily. If you find a way to pick 9 out of 9 races, please feel free to tell me about it!

Program Explanation

Lines 1 to 10 input names of jockeys for data file.
Lines 10 to 85 set up jockey list and menu.
Lines 90 to 160 input winner data from past races.
Lines 200 to 340 keep track of jockeys' records.
Lines 350 to 450 keep track of weights.
Lines 460 to 560 post position records.
Lines 570 to 800 store past records of horses.
Lines 2000 to 2070 load past data.
Lines 3000 to 3090 display data in file.
Lines 4000 to 4145 input today's race info.
Lines 5000 to 5140 compute jockey data.
Lines 5150 to 5250 compute weight data
Lines 5260 to 5360 post position data.
Lines 5370 to 5590 past records of horses.
Lines 6000 to 6200 print predictions.
Lines 7000 to 7070 save all data.



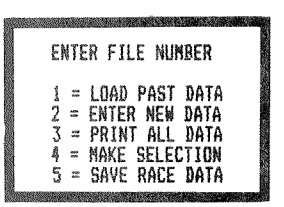


Figure 6.4 *Racetrac Program*

```
 1 CLEAR 1000:
   R = 1
 2 CLS :
   PRINT CHR$ (23)
 3 PRINT @460,"RACE TRACK COMPUTER":
   FOR  X = 1 TO 1000:
   NEXT :
   CLS
 4 PRINT "TYPE NAMES OF JOCKEYS FOR DATA FILE - HIT DOW
   N ARROW AFTER EACH NAME - WHEN COMPLETE LIST IS DONE
    HIT ENTER!  (MAX IS 15 NAMES)"
 5 PRINT :
   PRINT "EXAMPLE : A = PINCAY (DOWN ARROW) B = OLIVARE
   S (DOWN ARROW)"
 6 INPUT A$:
   CLS
10 CLS :
   R = 1
20 PRINT "ENTER FILE NUMBER":
   PRINT
30 PRINT "1 = LOAD PAST DATA":
   PRINT "2 = ENTER NEW DATA":
   PRINT "3 = PRINT ALL DATA":
   PRINT "4 = MAKE SELECTION":
   PRINT "5 = SAVE RACE DATA"
40 I$ = INKEY$ :
   IF   I$ = ""
   THEN 40 ..................................................
50 IF   I$ = "1"
   THEN 2000 ................................................
60 IF   I$ = "2"
   THEN 90 ..................................................
70 IF   I$ = "3"
   THEN 3000 ................................................
80 IF   I$ = "4"
   THEN 4000 ................................................
85 IF   I$ = "5"
   THEN 7000 ................................................
90 INPUT "ENTER NUMBER OF RACES FOR TODAYS DATA";RA:
   XX = XX + RA
100 PRINT A$
110 PRINT @30,"ENTER DATA FOR RACE # ";R;
120 PRINT @158,"WINNER";:
   WI$ = INKEY$ :
   IF   WI$ = ""
   THEN 120: ................................................
   ELSE PRINT @166,WI$;
130 PRINT @222,"WEIGHT";:
   WE$ = INKEY$ :
   IF   WE$ = ""
```

```
     THEN 130: ..................................................
     ELSE PRINT @230,WE$;
140  PRINT @286,"POST #";:
     PO$ = INKEY$ :
     IF   PO$ = ""
     THEN 140: ..................................................
     ELSE PRINT @294,PO$;
150  PRINT @350,"P/RECD";:
     PA$ = INKEY$ :
     IF   PA$ = ""
     THEN 150: ..................................................
     ELSE PRINT @358,PA$;
160  GOSUB 200:
     R = R + 1:
     IF   R = RA + 1
     THEN 10: ...................................................
     ELSE CLS :
          GOTO 100 ..............................................
-------------------------------------------------------------------
200  IF   WI$ = "A"
     THEN A = A + 1
210  IF   WI$ = "B"
     THEN B = B + 1
220  IF   WI$ = "C"
     THEN C = C + 1
230  IF   WI$ = "D"
     THEN D = D + 1
240  IF   WI$ = "E"
     THEN E = E + 1
250  IF   WI$ = "F"
     THEN F = F + 1
260  IF   WI$ = "G"
     THEN G = G + 1
270  IF   WI$ = "H"
     THEN H = H + 1
280  IF   WI$ = "I"
     THEN I = I + 1
290  IF   WI$ = "J"
     THEN J = J + 1
300  IF   WI$ = "K"
     THEN K = K + 1
310  IF   WI$ = "L"
     THEN L = L + 1
320  IF   WI$ = "M"
     THEN M = M + 1
330  IF   WI$ = "N"
     THEN N = N + 1
340  IF   WI$ = "O"
     THEN O = O + 1
350  REM  ***************** WEIGHT
360  IF   WE$ = "0"
```

```
    THEN W = W + 110
370 IF   WE$ = "1"
    THEN W = W + 111
380 IF   WE$ = "2"
    THEN W = W + 112
390 IF   WE$ = "3"
    THEN W = W + 113
400 IF   WE$ = "4"
    THEN W = W + 114
410 IF   WE$ = "5"
    THEN W = W + 115
420 IF   WE$ = "6"
    THEN W = W + 116
430 IF   WE$ = "7"
    THEN W = W + 117
440 IF   WE$ = "8"
    THEN W = W + 118
450 IF   WE$ = "9"
    THEN W = W + 119
460 REM  ***************************** POST POSITIONS
470 IF   PO$ = "1"
    THEN P = P + 1
480 IF   PO$ = "2"
    THEN P = P + 2
490 IF   PO$ = "3"
    THEN P = P + 3
500 IF   PO$ = "4"
    THEN P = P + 4
510 IF   PO$ = "5"
    THEN P = P + 5
520 IF   PO$ = "6"
    THEN P = P + 6
530 IF   PO$ = "7"
    THEN P = P + 7
540 IF   PO$ = "8"
    THEN P = P + 8
550 IF   PO$ = "9"
    THEN P = P + 9
560 IF   PO$ = "0"
    THEN P = P + 10
570 REM  ********************** PAST RECORDS
580 IF   PA$ = "0"
    THEN HO = 0
590 IF   PA$ = "1"
    THEN HO = 1
600 IF   PA$ = "2"
    THEN HO = 2
620 IF   PA$ = "4"
    THEN HO = 4
622 IF   PA$ = "5"
    THEN HO = 5
```

```
 624 IF    PA$ = "6"
     THEN HO = 6
 626 IF    PA$ = "7"
     THEN HO = 7
 628 IF    PA$ = "8"
     THEN HO = 8
 630 IF    WI$ = "A" AND HO > Ø
     THEN Al = HØ
 640 IF    WI$ = "B" AND HO > Ø
     THEN Bl = HO
 650 IF    WI$ = "C" AND HO > Ø
     THEN Cl = HO
 660 IF    WI$ = "D" AND HO > Ø
     THEN Dl = HO
 670 IF    WI$ = "E" AND HO > Ø
     THEN El = HO
 680 IF    WI$ = "F" AND HO > Ø
     THEN Fl = HO
 690 IF    WI$ = "G" AND HO > Ø
     THEN Gl = HO
 700 IF    WI$ = "H" AND HO > Ø
     THEN Hl = HO
 710 IF    WI$ = "I" AND HO > Ø
     THEN Il = HO
 720 IF    WI$ = "J" AND HO > Ø
     THEN Jl = HO
 730 IF    WI$ = "K" AND HO > Ø
     THEN Kl = HO
 740 IF    WI$ = "L" AND HO > Ø
     THEN Ll = HO
 750 IF    WI$ = "M" AND HO > Ø
     THEN Ml = HO
 760 IF    WI$ = "N" AND HO > Ø
     THEN Nl = HO
 770 IF    WI$ = "O" AND HO > Ø
     THEN Ol = HO
 800 RETURN
-------------------------------------------------------------------------------
1000 GOTO 1000
-------------------------------------------------------------------------------
2000 CLS
2010 PRINT @466,"LOADING DATA"
2020 INPUT # - 1,A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,W,XX,A$
2030 CLS
2040 PRINT @466,"DATA LOAD COMPLETE"
2050 FOR  X = 1 TO 1000:
     NEXT
2060 CLS
2070 GOTO 20Ø
-------------------------------------------------------------------------------
3000 CLS
```

```
3010 PRINT A$;
3020 X = 20
3030 PRINT @X,A;:
     PRINT @84,B;:
     PRINT @148,C;:
     PRINT @212,D;:
     PRINT @276,E;:
     PRINT @340,F;:
     PRINT @404,G;:
     PRINT @468,H;:
     PRINT @532,I;:
     PRINT @596,J;:
     PRINT @660,K;:
     PRINT @724,L;:
     PRINT @788,M;:
     PRINT @852,N;:
     PRINT @916,O;
3040 PRINT @30,"RACES WON THIS SEASON";
3050 PRINT @94," ";
3060 PRINT @158,"AVERAGE WINNING WEIGHT =";:
     WE = INT (W / XX):
     PRINT WE;
3070 PRINT @222,"BEST POST POSITION     =";:
     PO = INT (P / XX):
     PRINT PO;
3090 PRINT @350,"HIT ENTER TO CONTINUE";:
     INPUT I$:
     GOTO 10
```

```
4000 PP = 1:
     T1 = 0:
     T2 = 0:
     T3 = 0:
     T4 = 0:
     T5 = 0:
     T6 = 0:
     T7 = 0:
     T8 = 0:
     T9 = 0
4010 CLS :
     INPUT "HOW MANY HORSES IN RACE (MAX IS 9)";I2:
     CLS
4030 PRINT "ENTER DATA FOR RACE # ";PP
4040 PRINT @146,"HORSE, JOCKEY CODE, WEIGHT, POST#, PAST
     RECORD";
4050 PRINT @210,"";:
     INPUT H1$,J1$,W1,P1,R1:
     GOSUB 5000
4055 T1 = T1 + T:
     I1 = I1 + 1:
     IF   I1 = I2
```

```
     THEN 6000 ..................................................
4060 PRINT @274,"";:
     INPUT H2$,J1$,W2,P2,R2:
     GOSUB 5000
4065 T2 = T2 + T:
     I1 = I1 + 1:
     IF   I1 = I2
     THEN 6000 ..................................................
4070 PRINT @338,"";:
     INPUT H3$,J1$,W3,P3,R3:
     GOSUB 5000
4075 T3 = T3 + T:
     I1 = I1 + 1:
     IF   I1 = I2
     THEN 6000 ..................................................
4080 PRINT @402,"";:
     INPUT H4$,J1$,W4,P4,R4:
     GOSUB 5000
4085 T4 = T4 + T:
     I1 = I1 + 1:
     IF   I1 = I2
     THEN 6000 ..................................................
4090 PRINT @466,"";:
     INPUT H5$,J1$,W5,P5,R5:
     GOSUB 5000
4095 T5 = T5 + T:
     I1 = I1 + 1:
     IF   I1 = I2
     THEN 6000 ..................................................
4100 PRINT @530,"";:
     INPUT H6$,J1$,W6,P6,R6:
     GOSUB 5000
4105 T6 = T6 + T:
     I1 = I1 + 1:
     IF   I1 = I2
     THEN 6000 ..................................................
4110 PRINT @594,"";:
     INPUT H7$,J1$,W7,P7,R7:
     GOSUB 5000
4115 T7 = T7 + T:
     I1 = I1 + 1:
     IF   I1 = I2
     THEN 6000 ..................................................
4120 PRINT @658,"";:
     INPUT H8$,J1$,W8,P8,R8:
     GOSUB 5000
4125 T8 = T8 + T:
     I1 = I1 + 1:
     IF   I1 = I2
     THEN 6000 ..................................................
4130 PRINT @722,"";:
```

```
     INPUT H9$,J1$,W9,P9,R9:
     GOSUB 5000
4135 T9 = T9 + T:
     GOTO 6000
-------------------------------------------------------------------------
5000 IF   J1$ = "A"
     THEN T = A
5010 IF   J1$ = "B"
     THEN T = B
5020 IF   J1$ = "C"
     THEN T = C
5030 IF   J1$ = "D"
     THEN T = D
5040 IF   J1$ = "E"
     THEN T = E
5050 IF   J1$ = "F"
     THEN T = F
5060 IF   J1$ = "G"
     THEN T = G
5070 IF   J1$ = "H"
     THEN T = H
5080 IF   J1$ = "I"
     THEN T = I
5090 IF   J1$ = "J"
     THEN T = J
5100 IF   J1$ = "K"
     THEN T = K
5110 IF   J1$ = "L"
     THEN T = L
5120 IF   J1$ = "M"
     THEN T = M
5130 IF   J1$ = "N"
     THEN T = N
5140 IF   J1$ = "O"
     THEN T = O
5150 REM  ******************** WEIGHT
5160 IF   W1 = WE
     THEN T1 = T1 + 1
5170 IF   W2 = WE
     THEN T2 = T2 + 1
5180 IF   W3 = WE
     THEN T3 = T3 + 1
5190 IF   W4 = WE
     THEN T4 = T4 + 1
5200 IF   W5 = WE
     THEN T5 = T5 + 1
5210 IF   W6 = WE
     THEN T6 = T6 + 1
5220 IF   W7 = WE
     THEN T7 = T7 + 1
5230 IF   W8 = WE
```

```
            THEN T8 = T8 + 1
      5240  IF   W9 = WE
            THEN T9 = T9 + 1
      5250  W1 = 0:
            W2 = 0:
            W3 = 0:
            W4 = 0:
            W5 = 0:
            W6 = 0:
            W7 = 0:
            W8 = 0:
            W9 = 0
      5260  REM  ************************** POST
      5270  IF   P1 = PO
            THEN T1 = T1 + 1
      5280  IF   P2 = PO
            THEN T2 = T2 + 1
      5290  IF   P3 = PO
            THEN T3 = T3 + 1
      5300  IF   P4 = PO
            THEN T4 = T4 + 1
      5310  IF   P5 = PO
            THEN T5 = T5 + 1
      5320  IF   P6 = PO
            THEN T6 = T6 + 1
      5330  IF   P7 = PO
            THEN T7 = T7 + 1
      5340  IF   P8 = PO
            THEN T8 = T8 + 1
      5350  IF   P9 = PO
            THEN T9 = T9 + 1
      5360  P1 = 0:
            P2 = 0:
            P3 = 0:
            P4 = 0:
            P5 = 0:
            P6 = 0:
            P7 = 0:
            P8 = 0:
            P9 = 0
      5370  REM  ************************** PAST RECORD
      5380  IF   R1 > 0
            THEN T1 = T1 + 1
      5390  IF   R2 > 0
            THEN T2 = T2 + 1
      5400  IF   R3 > 0
            THEN T3 = T3 + 1
      5410  IF   R4 > 0
            THEN T4 = T4 + 1
      5420  IF   R5 > 0
            THEN T5 = T5 + 1
```

```
5430 IF   R6 > Ø
     THEN T6 = T6 + 1
5440 IF   R7 > Ø
     THEN T7 = T7 + 1
5450 IF   R8 > Ø
     THEN T8 = T8 + 1
5460 IF   R9 > Ø
     THEN T9 = T9 + 1
5470 R1 = Ø:
     R2 = Ø:
     R3 = Ø:
     R4 = Ø:
     R5 = Ø:
     R6 = Ø:
     R7 = Ø:
     R8 = Ø:
     R9 = Ø
5590 RETURN
```

```
6000 CLS :
     I1 = Ø
6010 PRINT @466,"PLEASE WAIT FOR SELECTIONS"
6020 FOR  X = 1 TO 2000:
     NEXT
6030 CLS
6040 X = 500
6050 IF   T1 = X PRINT T1;H1$
6060 IF   T2 = X PRINT T2;H2$
6070 IF   T3 = X PRINT T3;H3$
6080 IF   T4 = X PRINT T4;H4$
6090 IF   T5 = X PRINT T5;H5$
6100 IF   T6 = X PRINT T6;H6$
6110 IF   T7 = X PRINT T7;H7$
6120 IF   T8 = X PRINT T8;H8$
6130 IF   T9 = X PRINT T9;H9$
6150 X = X - 1:
     IF   X = Ø PRINT @462,"SELECTIONS FOR RACE # ";PP;:
          GOTO 6160 .....................................
6155 GOTO 6050
```

```
6160 PRINT @590,"MORE RACES (Y/N)";
6170 INPUT I$
6175 IF   I$ = "N"
     THEN CLS :
          GOTO 20 ......................................
6180 PP = PP + 1:
     H1$ = "":
     H2$ = "":
     H3$ = "":
     H4$ = "":
     H5$ = "":
```

```
      H6$ = "":
      H7$ = "":
      H8$ = "":
      H9$ = ""
 6190 T = 0:
      T1 = 0:
      T2 = 0:
      T3 = 0:
      T4 = 0:
      T5 = 0:
      T6 = 0:
      T7 = 0:
      T8 = 0:
      T9 = 0
 6200 CLS :
      GOTO 4010
```

```
 7000 CLS
 7010 PRINT @468,"SAVING DATA"
 7020 PRINT # - 1,A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,W,XX,A$
 7030 CLS
 7040 PRINT @468,"DATA SAVED"
 7050 FOR  X = 1 TO 1000:
      NEXT
 7060 CLS
 7070 GOTO 20
```

7

Methods of Display Using Block Moves

The FIND THE STATES program makes use of a block move of the complete screen.

FIND THE STATES

In FIND THE STATES, a large map of the United States is displayed on the screen. You are given a state's capital and nickname, and you attempt to find the correct state on the map by placing the movable indicator on it. You move the indicator using the arrow keys. The game asks you 20 questions, and you are given a time limit to find the correct state.

The timer lasts long enough for you to go around the screen twice before your time is up. This should be enough to find the correct state if you know where it is, but if not, you haven't got much time for guessing.

The game keeps your score and gives the percentage of correct answers at the end of the game. This game saves the map in memory and makes a block move to the screen at the start of each question.

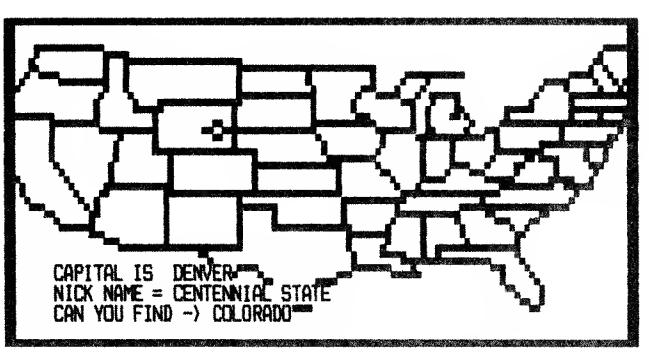


Figure 7.1 *Find the States Program*

```
  5 CLS :
    PRINT CHR$ (23):
    PRINT @460,"FIND THE STATES"
 10 IF   PEEK (16396) = 201
    THEN L$ = "T":
    ELSE L$ = "D"
 11 IF   L$ = "T"
    THEN A = 31700:
    ELSE A = - 23836
 20 READ B:
    IF   B = - 0
    THEN 450 ..................................................
 30 POKE A,B:
    A = A + 1:
    GOTO 20
-------------------------------------------------------------------
 40 DATA 128,128,128,156,140,140,140,140,140,140,176,176
    ,144,128,128,128,128,128,128,128,128,128,128,128
    ,128,128,128,128,128,128,128,128,128,128,128,128
    ,128,128,128,128,128,128,128,128,128,128,128,128
    ,128,128,128,128,128
 50 DATA 128,128,128,128,152,140,140,148
 60 REM  B$
 70 DATA 128,128,154,164,176,144,128,128,128,128,149,128
    ,151,131,131,131,131,131,131,131,131,131,171,140
    ,140,140,140,140,140,172,140,140,140,140,140,140,148
    ,128,128,160,176,176,176,176,176,144,128,128,128,128
    ,128,128,128,128,128,128
 80 DATA 176,176,150,137,144,128,149
 90 REM  C$
100 DATA 160,134,128,128,128,130,131,131,131,163,133,128
    ,165,128,128,128,128,128,128,128,128,128,128,170,176
    ,176,176,176,176,176,178,148,128,128,128,160,140,165
    ,176,184,129,160,134,176,176,176,128,128,128,128,128
    ,128,128,160,134
110 DATA 131,139,176,176,178,180,178,182,128
120 REM  D$
130 DATA 170,176,176,176,176,128,128,128,128,149,128,128
    ,128,141,140,158,131,131,131,131,131,131,131,151,128
    ,128,128,128,128,128,128,149,128,128,128,165,176,128
    ,128,128,131,149,168,129,128,186,164,128,128,128,168
    ,140,140,133,128
140 DATA 128,128,157,140,140,156,140,172,133
150 REM  E$
160 DATA 149,128,128,128,170,131,131,131,131,137,140,172
    ,140,140,140,149,128,128,128,128,128,128,157,140
    ,140,140,140,140,140,140,167,131,131,131,131,131,137
    ,156,140,140,165,186,180,176,176,184,177,152,172,131
    ,131,131,131,131
170 DATA 131,151,131,131,131,131,179,135,128
```

```
180 REM  F$
190 DATA 165,128,128,128,170,128,128,128,128,128,128,149
    ,128,128,128,141,172,140,140,140,140,140,140,141,140
    ,148,128,128,128,128,128,128,165,176,176,176,176,152
    ,129,128,128,128,149,128,128,149,128,128,128,154,140
    ,140,172,156
200 DATA 183,179,131,131,171,131,171,129,128,128
210 REM  G$
220 DATA 138,144,128,128,128,137,144,128,128,128,170,128
    ,128,128,128,128,170,128,128,128,128,128,128,128,128
    ,151,131,131,131,131,131,131,171,128,128,128,130
    ,140,144,128,128,181,176,152,131,131,140,166,176,176
    ,154,129
230 DATA 128,128,186,176,144,128,155,129,128,128,128
240 REM  H$
250 DATA 128,138,144,128,128,128,130,164,128,152,135,131
    ,131,131,131,131,159,140,140,140,140,140,140,172,140
    ,141,140,140,140,140,140,140,140,142,176,176,176,176
    ,176,178,156,142,140,140,140,140,140,140,156,140,131
    ,131,131,131,131
260 DATA 129,130,155,131,129,128,128,128,128
270 REM  I$
280 DATA 128,128,130,131,140,144,128,128,169,133,128,128
    ,128,128,128,128,149,128,128,128,128,128,128,170,131
    ,131,131,149,128,128,128,128,128,128,149,128,128,128
    ,128,154,140,140,156,140,140,172,131,131,139,167,179
    ,131,131,179
290 DATA 143,131,131,128,128,128,128,128,128,128,128
300 REM  J$
310 DATA 128,128,128,128,128,130,131,131,139,140,176,144
    ,128,128,128,128,149,128,128,128,128,128,128,170,128
    ,128,128,131,131,131,131,131,131,131,171,140,140,140
    ,174,128,128,128,149,128,128,128,165,128,128,128,128
    ,169,134
320 DATA 128,128,128,128,128,128,128,128,128,128,128,128
330 REM  K$
340 DATA 128,128,128,128,128,128,128,128,128,128,128,130
    ,131,131,131,131,131,131,131,139,167,131,131,131,128
    ,128,128,128,128,128,128,128,128,128,130,148,128,128
    ,141,140,180,176,181,186,179,179,179,179,179,131,131
    ,139,144
350 DATA 128,128,128,128,128,128,128,128,128,128,128,128
360 REM  L$
370 DATA 128,128,128,128,128,128,128,128,128,128,128,128,128
    ,128,128,128,128,128,128,128,128,128,137,140,134,131
    ,137,176,128,128,128,128,160,176,152,140,131,131,131
    ,131,140,140,141,128,128,128,128,128,128,128,131,149
    ,128,130,164
380 DATA 128,128,128,128,128,128,128,128,128,128,128
390 REM  M$
400 DATA 128,128,128,128,128,128,128,128,128,128,128,128,128
```

```
    ,128,128,128,128,128,128,128,128,128,128,128,128,128
    ,128,128,137,176,128,168,129,128,128,128,128,128,128
    ,128,128,128,128,128,128,128,128,128,128,128,128,130
    ,137,176,128
410 DATA 149,128,128,128,128,128,128,128,128,128
420 REM  N$
430 DATA 128,128,128,128,128,128,128,128,128,128,128,128
    ,128,128,128,128,128,128,128,128,128,128,128,128,128
    ,128,128,128,128,131,131,128,128,128,128,128,128,128
    ,128,128,128,128,128,128,128,128,128,128,128,128,128
    ,128,128,131
440 DATA 128,128,128,128,128,128,128,128,128,128,-0
450 IF   L$ = "D"
    THEN Z = - 21836:
    ELSE Z = 31488
460 FOR  X = Z TO Z + 11:
         READ D:
         POKE X,D:
    NEXT
470 DATA 17,64,60,33,212,123,1,128,3,237,176,201
480 IF   L$ = "T" POKE 16526,0:
         POKE 16527,123
490 IF   L$ = "D" POKE Z + 4,228:
         POKE Z + 5,162:
         DEF USR 0 = - 21836
600 CLS :
    A = USR (0)
605 PRINT @0,"CORRECT ANSWERS ";SC;:
    PRINT @40,"WRONG ANSWERS ";W;
620 R = RND (49):
    IF   R = 8
    THEN 620 ..................................................
630 IF   R = 1S$ = "ALABAMA":
         N$ = "COTTON STATE":
         C$ = "MONTGOMERY":
         L = 16044
640 IF   R = 2S$ = "ARIZONA":
         N$ = "APACHE STATE":
         C$ = "PHOENIX":
         L = 15948
650 IF   R = 3S$ = "ARKANSAS":
         N$ = "WONDER STATE":
         C$ = "LITTLE ROCK":
         L = 15972
660 IF   R = 4S$ = "CALIFORNIA":
         N$ = "GOLDEN STATE":
         C$ = "SACRAMENTO":
         L = 15746
670 IF   R = 5S$ = "COLORADO":
         N$ = "CENTENNIAL STATE":
         C$ = "DENVER":
```

```
        L = 15828
680 IF  R = 6S$ = "CONNECTICUT":
        N$ = "NUTMEG STATE":
        C$ = "HARTFORD":
        L = 15674
690 IF  R = 7S$ = "DELAWARE":
        N$ = "DIAMOND STATE":
        C$ = "DOVER":
        L = 15803
710 IF  R = 9S$ = "FLORIDA":
        N$ = "PENINSULA STATE":
        C$ = "TALLAHASSEE":
        L = 16179
720 IF  R = 10S$ = "GEORGIA":
        N$ = "CRACKER STATE":
        C$ = "ATLANTA":
        L = 16049
730 IF  R = 11S$ = "IDAHO":
        N$ = "GEM STATE":
        C$ = "BOISE":
        L = 15627
740 IF  R = 12S$ = "ILLINOIS":
        N$ = "PRAIRIE STATE":
        C$ = "SPRINGFIELD":
        L = 15784
750 IF  R = 13S$ = "INDIANA":
        N$ = "HOOSIER STATE":
        C$ = "INDIANAPOLIS":
        L = 15787
760 IF  R = 14S$ = "IOWA":
        N$ = "HAWKEYE STATE":
        C$ = "DES MOINES":
        L = 15714
770 IF  R = 15S$ = "KANSAS":
        N$ = "SUNFLOWER STATE":
        C$ = "TOPEKA":
        L = 15836
780 IF  R = 16S$ = "KENTUCKY":
        N$ = "BLUE GRASS STATE":
        C$ = "FRANKFORT":
        L = 15854
790 IF  R = 17S$ = "LOUISIANA":
        N$ = "PELICAN STATE":
        C$ = "BATON ROUGE":
        L = 16100
800 IF  R = 18S$ = "MAINE":
        N$ = "PINE TREE STATE":
        C$ = "AUGUSTA":
        L = 15549
810 IF  R = 19S$ = "MARYLAND":
        N$ = "OLD LINE STATE":
```

```
            C$ = "ANNAPOLIS":
            L = 15803
820 IF      R = 20S$ = "MASSACHUSETTS":
            N$ = "BAY STATE":
            C$ = "BOSTON":
            L = 15675
830 IF      R = 21S$ = "MICHIGAN":
            N$ = "WOLVERINE STATE":
            C$ = "LANSING":
            L = 15660
840 IF      R = 22S$ = "MINNESOTA":
            N$ = "NORTH STAR STATE":
            C$ = "ST.PAUL":
            L = 15585
850 IF      R = 23S$ = "MISSISSIPPI":
            N$ = "MAGNOLIA STATE":
            C$ = "JACKSON":
            L = 16040
860 IF      R = 24S$ = "MISSOURI":
            N$ = "SHOW ME STATE":
            C$ = "JEFFERSON CITY":
            L = 15843
870 IF      R = 25S$ = "MONTANA":
            N$ = "TREASURE STATE":
            C$ = "HELENA":
            L = 15564
880 IF      R = 26S$ = "NEBRASKA":
            N$ = "CORNHUSKER STATE":
            C$ = "LINCOLN":
            L = 15772
890 IF      R = 27S$ = "NEVADA":
            N$ = "SAGEBRUSH STATE":
            C$ = "CARSON CITY":
            L = 15751
900 IF      R = 28S$ = "NEW HAMPSHIRE":
            N$ = "GRANITE STATE":
            C$ = "CONCORD":
            L = 15548
910 IF      R = 29S$ = "NEW JERSEY":
            N$ = "GARDEN STATE":
            C$ = "TRENTON":
            L = 15738
920 IF      R = 30S$ = "NEW MEXICO":
            N$ = "CACTUS STATE":
            C$ = "SANTA FE":
            L = 15956
930 IF      R = 31S$ = "NEW YORK":
            N$ = "EMPIRE STATE":
            C$ = "ALBANY":
            L = 15670
940 IF      R = 32S$ = "NORTH CAROLINA":
```

```
            N$ = "TAR HEEL STATE":
            C$ = "RALEIGH":
            L = 15924
 950 IF     R = 33S$ = "NORTH DAKOTA":
            N$ = "FLICKERTAIL STATE":
            C$ = "BISMARCK":
            L = 15579
 960 IF     R = 34S$ = "OHIO":
            N$ = "BUCKEYE STATE":
            C$ = "COLUMBUS":
            L = 15791
 970 IF     R = 35S$ = "OKLAHOMA":
            N$ = "SOONER STATE":
            C$ = "OKLAHOMA CITY":
            L = 15966
 980 IF     R = 36S$ = "OREGON":
            N$ = "BEAVER STATE":
            C$ = "SALEM":
            L = 15556
 990 IF     R = 37S$ = "PENNSYLVANIA":
            N$ = "KEYSTONE STATE":
            C$ = "HARRISBURG":
            L = 15732
1000 IF     R = 38S$ = "RHODE ISLAND":
            N$ = "LITTLE RHODY":
            C$ = "PROVIDENCE":
            L = 15677
1010 IF     R = 39S$ = "SOUTH CAROLINA":
            N$ = "PALMETTO STATE":
            C$ = "COLUMBIA":
            L = 15987
1020 IF     R = 40S$ = "SOUTH DAKOTA":
            N$ = "SUNSHINE STATE":
            C$ = "PIERRE":
            L = 15643
1030 IF     R = 41S$ = "TENNESSEE":
            N$ = "VOLUNTEER STATE":
            C$ = "NASHVILLE":
            L = 15915
1040 IF     R = 42S$ = "TEXAS":
            N$ = "LONE STAR STATE":
            C$ = "AUSTIN":
            L = 16093
1050 IF     R = 43S$ = "UTAH":
            N$ = "DESERET":
            C$ = "SALT LAKE CITY":
            L = 15821
1060 IF     R = 44S$ = "VERMONT":
            N$ = "GREEN MOUNTAIN STATE":
            C$ = "MONTPELIER":
            L = 15610
```

```
1070 IF   R = 45S$ = "VIRGINIA":
          N$ = "OLD DOMINION":
          C$ = "RICHMOND":
          L = 15862
1080 IF   R = 46S$ = "WASHINGTON":
          N$ = "EVERGREEN STATE":
          C$ = "OLYMPIA":
          L = 15495
1090 IF   R = 47S$ = "WEST VIRGINIA":
          N$ = "PANHANDLE STATE":
          C$ = "CHARLESTON":
          L = 15857
1100 IF   R = 48S$ = "WISCONSIN":
          N$ = "BADGER STATE":
          C$ = "MADISON":
          L = 15654
1110 IF   R = 49S$ = "WYOMING":
          N$ = "EQUALITY STATE":
          C$ = "CHEYENNE":
          L = 15699
2000 PRINT @832,"NICK NAME = ";N$;
2010 PRINT @768,"CAPITAL IS  ";C$;
2020 PRINT @896,"CAN YOU FIND -> ";S$;
2030 A = 16000
2040 IF   PEEK (14400) = 8
     THEN A = A - 64
2050 IF   PEEK (14400) = 16
     THEN A = A + 64
2060 IF   PEEK (14400) = 32
     THEN A = A - 1
2070 IF   PEEK (14400) = 64
     THEN A = A + 1
2075 IF   A < 15360 OR A > 16380
     THEN A = A1
2078 A1 = A
2080 B = PEEK (A):
     C = PEEK (A + 1):
     D = PEEK (A + 2)
2090 POKE A,140:
     POKE A + 1,179:
     POKE A + 2,140
2100 FOR  X = 1 TO 10:
     NEXT
2110 POKE A,B:
     POKE A + 1,C:
     POKE A + 2,D
2120 IF   A + 1 = L
     THEN FOR  X = 1 TO 50:
               OUT 255,0:
               OUT 255,2:
               NEXT :
```

```
                SC = SC + 1:
                T = 0:
                GOTO 600 ....................................
2130        T = T + 1:
            IF  T = 200W = W + 1:
                T = 0:
                GOTO 600 ....................................
2140        IF  W = 10 CLS :
                PRINT CHR$ (23):
                PRINT "END OF GAME":
                PRINT "YOU GOT";SC;"OUT OF";SC + W;"QUESTI
                ONS ":
                PRINT :
                PRINT "TO PLAY AGAIN HIT ENTER":
                INPUT I$:
                W = 0:
                SC = 0:
                T = 0:
                GOTO 600 ....................................
2150        GOTO 2040 ...................................
```

Program Explanation

Lines 10 through 60 print the name on the screen, and line 70 checks to be sure that the system is in LEVEL II TAPE. Lines 100 through 290 poke the score card into high memory. This is later block-moved to the screen when needed.

Lines 300 to 360 get the three initials of each player, and lines 370 to 425 block-move the score card to the screen, print the players' initials on the score card and move it back to high memory again.

Lines 430 to 489 print the dice on the screen. If the up arrow is pressed, execution jumps to lines 3000 to 3120 and draws the picture of the man running across the screen. When you release the up arrow key, you GOTO lines 520 to 690 to see whether the player wants to save, roll or enter score.

Lines 1990 to 2070 are the cursor and the score card controls, and lines 5000 to 18100 are where all computations take place for the scores. Don't even *think* about asking me how long I spent writing this section, — all I know is I never want to do it again!

Last (but not least) are lines 19000 to 19080, which total the scores and stop the game.

Las Wages POKER

The idea for this game came from spending a weekend in Las Vegas and losing about a hundred dollars playing one of those electronic slot machines. The game plays very much like the real ones in Vegas.

You start by pressing enter, and the computer will deal out your hand. Next, select the cards you wish to discard by pressing their number. Those cards are then turned face down, and the computer replaces them with new ones.

After checking your hand to see how well you did, press the <CLEAR> key, and the game starts over. This game is like playing five-card draw poker. The cards are shuffled again after each hand!

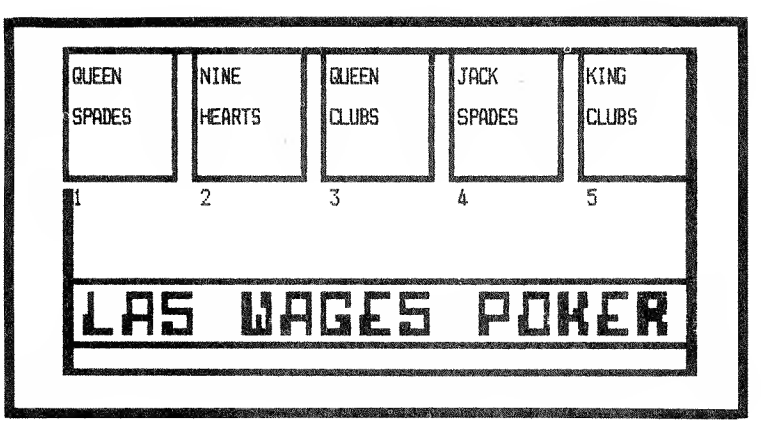
There is no score in the game, but it's good practice for learning how to play your hand, and you don't have to worry about losing $100.00!

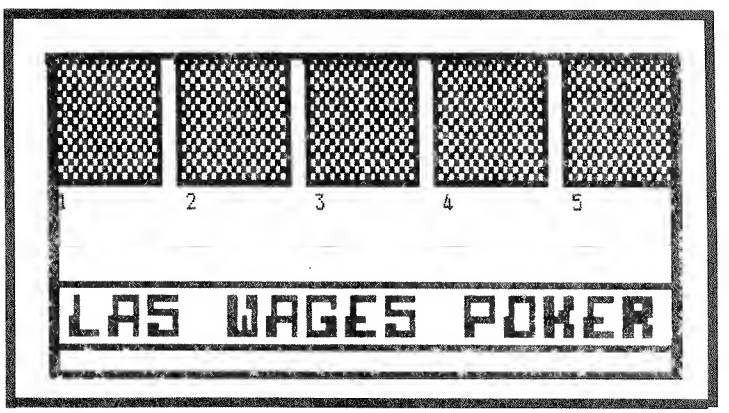
The game of poker consists of 52 cards divided into four suits: spades, hearts, diamonds and clubs. Each suit has 13 cards ranking in this order: ace (high), king, queen, jack, 10, 9, 8, 7, 6, 5, 4, 3 and 2 (low). From two to eight people play in an actual game, — unless they're playing a slot machine.

Below is a list of the poker hands, starting with the highest-ranked first.

Straight Flush — five cards of the same suit and in sequence. The ace-high straight flush is called a Royal Flush.
Four of a Kind — such as four 7's.
Full House — three of one kind and two of another, such as 10, 10, 10, 3 and 3.
Flush — five cards of the same suit.
Straight — five cards in sequence, but having two or more suits.
Three of a Kind — such as 10, 10, 10, 3 and 8.
Two Pairs — such as 10, 10, Q, Q and 2.
One Pair — such as 10, 10, 2, 3 and 4.

If two players have the same hand, the one with the highest card wins. If both have exactly the same cards, they tie. There are 2,598,960 possible poker hands, but only 40 are straight flushes.




1
2
3
4
5
LAS WAGES POKER

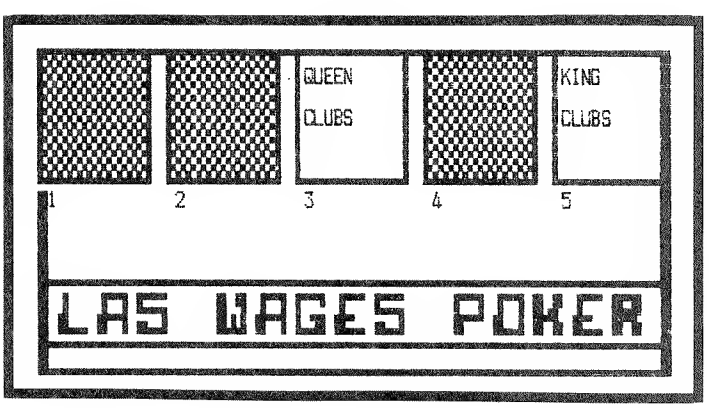

QUEEN
CLUBS
KING
CLUBS
1
2
3
4
5
LAS WAGES POKER

Figure 7.2 *Las Wages Poker Program*

```
1000 CLEAR 1000:
     RANDOM :
     DIM A$(13),C(52)
3000 A1$ = " TROFF SET SET SET SET SET SET SET SET SET SET

ELSE END TROFF SET SET SET SET SET SET SET SET SET SET
END TROFF SET SET SET SET SET SET SET SET SET SET
END TROFF SET SET SET SET SET SET SET SET SET SET
END TROFF SET SET SET SET SET SET SET SET SET SET

END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END

END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
"
```

```
3010 A2$ = "
ELSE END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END

END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
```

```
END END END END END END END END END END

END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
END
END END END END END END END END END END
"
```

```
3020 A3$ = " GOTO LET LET LET LET LET LET LET LET LET LET
     CMD END GOTO LET LET LET LET LET LET LET LET LET LET
     CMD END GOTO LET LET LET LET LET LET LET LET LET LET
     CMD END GOTO LET LET LET LET LET LET LET LET LET LET
     CMD END GOTO LET LET LET LET LET LET LET LET LET LET
     CMD END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END "
```

```
3030 A4$ = " END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     LINE LET LET LET LET LET LET LET LET LET LET LET LET
     LET LET LET LET LET LET LET LET LET LET LET LET LET
     LET LET LET LET LET LET LET LET LET LET LET LET LET
     LET LET LET LET LET LET LET LET LET LET LET LET LET
     LET LET LET LET LET LET LET LET LET LET LET RSET "
3040 A5$ = "
ELSE END KILL END END END KILL SET LSET END AUTO CONT CONT
     END END END END END USING END LPRINT END KILL SET LSET
     END TROFF SET READ END KILL SET SET END AUTO CONT CONT
     END END END END END TROFF SET LSET END KILL SET LSET
     END USING OUT RESUME END KILL SET SET END USING CONT
     USING END END KILL
```

```
END USING DEF DEF END USING SET LSET END TAB( DEF CSAVE END
     END END END END USING CSAVE CSAVE END USING SET LSET
     END LLIST PRINT USING END USING CONT DEF END TAB( DEF
     CSAVE END END END END USING SET SET END USING DEF
     CSAVE END USING SET TO END USING CONT DEF END USING
     SET TO END END KILL GOTO LET LET LET LET LET LET LET
     LET LET LET LET LET LET LET LET LET LET LET LET LET
     LET LET LET LET LET LET LET LET LET LET LET LET LET
     LET LET LET LET LET LET LET LET LET LET LET LET LET
     LET LET LET LET LET LET LET LET LET LET LET LET LET
     LET LET LET RUN "
-------------------------------------------------------------------------------
3050 A6$ = " END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     "
-------------------------------------------------------------------------------
3060 CLS :
     PRINT A1$;A2$;A3$;A4$;A5$;A6$;
3065 ZZ = 448:
     FOR  X = 1 TO 5:
          PRINT @ZZ,X;:
          ZZ = ZZ + 13:
     NEXT
3070 A$ = CHR$ (159) + STRING$ (10,155)
3072 B$ = CHR$ (183) + STRING$ (10,166)
3073 C$ = CHR$ (157) + STRING$ (10,153)
3074 D$ = STRING$ (11,141)
3080 IF   C1 = 0 PRINT @0,A$;:
          PRINT @64,B$;:
          PRINT @128,C$;:
          PRINT @192,B$;:
          PRINT @256,C$;:
          PRINT @320,B$;:
          PRINT @384,D$;
3090 IF   C2 = 0 PRINT @13,A$;:
          PRINT @77,B$;:
          PRINT @141,C$;:
          PRINT @205,B$;:
          PRINT @269,C$;:
          PRINT @333,B$;:
          PRINT @397,D$;
3100 IF   C3 = 0 PRINT @26,A$;:
          PRINT @90,B$;:
          PRINT @154,C$;:
          PRINT @218,B$;:
          PRINT @282,C$;:
          PRINT @346,B$;:
          PRINT @410,D$;
```

```
3110 IF   C4 = 0 PRINT @39,A$;:
          PRINT @103,B$;:
          PRINT @167,C$;:
          PRINT @231,B$;:
          PRINT @295,C$;:
          PRINT @359,B$;:
          PRINT @423,D$;
3120 IF   C5 = 0 PRINT @52,A$;:
          PRINT @116,B$;:
          PRINT @180,C$;:
          PRINT @244,B$;:
          PRINT @308,C$;:
          PRINT @372,B$;:
          PRINT @436,D$;
3125 IF   T = 1 RETURN  ....................................
3130 IF   PEEK (14400) < > 1
     THEN 3130 ..............................................
3140 A$ = CHR$ (151) + STRING$ (10,131)
3150 B$ = CHR$ (149) + STRING$ (10,128)
3160 C$ = CHR$ (149) + STRING$ (10,128)
3170 D$ = CHR$ (141) + STRING$ (10,140)
3175 IF   T = 2 RETURN  ....................................
3180 T = 1:
     GOSUB 3080
4030 A$(1) = "ACE"
4040 A$(2) = "TWO"
4050 A$(3) = "THREE"
4060 A$(4) = "FOUR"
4070 A$(5) = "FIVE"
4080 A$(6) = "SIX"
4090 A$(7) = "SEVEN"
4100 A$(8) = "EIGHT"
4110 A$(9) = "NINE"
4120 A$(10) = "TEN"
4130 A$(11) = "JACK"
4140 A$(12) = "QUEEN"
4150 A$(13) = "KING"
4160 B$(1) = "HEARTS"
4170 B$(2) = "CLUBS"
4180 B$(3) = "DIAMONDS"
4190 B$(4) = "SPADES"
4200 FOR  I = 1 TO 52:
          C(I) = I:
     NEXT I
4210 D = 53
4240 FOR  I = 1 TO 5
4250      D = D - 1
4260      X = INT (D * RND (0) + 1)
4270      H(I) = C(X)
4280      C(X) = C(D)
4290      Q = INT ((H(I) - 1) / 13)
```

```
4300        Y = H(I) - 1 - Q * 13
4310        H$(I) = A$(Y + 1)
4315        Z$(I) = B$(Q + 1)
4320 NEXT I
4325 IF     T = 0 RETURN  ..........................................
4330 PP = 65
4350 FOR    J = 1 TO 5
4360        PRINT @PP,H$(J);:
            PRINT @PP + 128,Z$(J);:
            PP = PP + 13
4370 NEXT J
4380 C1 = 1:
     C2 = 1:
     C3 = 1:
     C4 = 1:
     C5 = 1:
     E = 0
4390 I$ = INKEY$ :
     IF    I$ = ""
     THEN 4390 ..............................................
4410 IF    I$ = "1"
     THEN C1 = 0:
          E = E + 1
4420 IF    I$ = "2"
     THEN C2 = 0:
          E = E + 1
4430 IF    I$ = "3"
     THEN C3 = 0:
          E = E + 1
4440 IF    I$ = "4"
     THEN C4 = 0:
          E = E + 1
4450 IF    I$ = "5"
     THEN C5 = 0:
          E = E + 1
4452 IF    PEEK (14400) = 1
     THEN 5000 ..............................................
4455 IF    E = 4
     THEN 5000 ..............................................
4460 GOSUB 3070:
     I$ = "":
     GOTO 4390
-------------------------------------------------------------------
5000 T = 2:
     GOSUB 3140
5010 T = 1:
     GOSUB 3080
5020 T = 0:
     GOSUB 4030
5030 FOR  J = 1 TO 5
5040        IF   C1 = 0 PRINT @65,H$(J);:
```

```
                PRINT @193,Z$(J);:
                C1 = 1:
                NEXT
5050        IF  C2 = 0 PRINT @78,H$(J);:
                PRINT @206,Z$(J);:
                C2 = 1:
                NEXT
5060        IF  C3 = 0 PRINT @91,H$(J);:
                PRINT @219,Z$(J);:
                C3 = 1:
                NEXT
5070        IF  C4 = 0 PRINT @104,H$(J);:
                PRINT @232,Z$(J);:
                C4 = 1:
                NEXT
5080        IF  C5 = 0 PRINT @117,H$(J);:
                PRINT @245,Z$(J);:
                C5 = 1:
                NEXT
5090 NEXT
6000 IF   PEEK (14400) < > 2
     THEN 6000: ....................................................
     ELSE RUN   ....................................................
```

Program Explanation

Line 5 clears the screen; prints the title.
Lines 10 to 30 save the map in memory.
Lines 40 to 440 are data lines.
Lines 450 to 600 get the block move routine in memory.
Line 605 keeps the scores.
Line 620 selects the questions.
Lines 630 to 1110 are data for questions and screen locations.
Lines 2000 to 2020 print data on states.
Lines 2030 to 2110 move indicator.
Lines 2120 to 2130 sound and points.
Lines 2140 to 2150 end of game.

Computer YAHTZEE

Computer YAHTZEE is played very much like the original game. The chief difference is that you are allowed only one yahtzee per player, and up to four players can play. The game is also cheat-proof. The computer keeps the scores, but it lets the players select where they wish to place their scores the board. If you try to put 3-of-a-kind on the space marked Full House, the computer will give a zero score in that position. After the last player has made his last roll at the end of the game, the computer totals all the players' scores and ends the game.

This game has a lot of graphics in it. As you roll the dice by pressing the up arrow, a little man runs across the screen to let you know you are still rolling. When you release the up arrow key, the man is cleared from the screen and you have the option of keeping the dice or rolling again.

Each player is allowed three rolls, and the screen shows the dice that you save from each roll. After your third roll, you go to the score card and move the cursor on the screen to the position where you want to place your score. Do this by using the up or down arrow. The score card on the screen is fully protected from a player making an improper move. After the cursor is in the correct position on the card, press the space bar to enter your score; then press the clear key to continue playing.

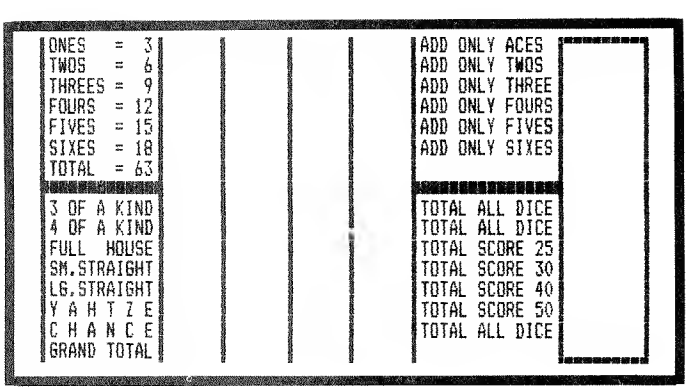


Figure 7.3 *YAHTZEE Program*

```
 10 CLS :
    CLEAR 2000:
   ' COMPUTER YAHTZEE BY TOM DEMPSEY
 20 PRINT CHR$ (23):
    PRINT
 30 PRINT STRING$ (32,191);
 40 FOR  X = 1 TO 12:
         PRINT CHR$ (191) + STRING$ (30,128) + CHR$ (191
         );:
    NEXT
 50 PRINT STRING$ (32,191);
 60 PRINT @466,"Y A H T Z E E";
 70 FOR  X = 1 TO 500:
    NEXT :
    CLS
100 DATA 149,79,78,69,83,128,128,128,61,128,128,51,170,1
    28,128,128,128,128,128,149,128,128,128,128,128,128,1
    49,128,128,128,128,128,170,128,128,128,128,128,128,1
    49,65,68,68,128,79,78,76,89,128,65,67,69,83,128,170,
    131
110 DATA 131,131,131,131,131,131,131,171,149,84,87,79,83
    ,128,128,128,61,128,128,54,170,128,128,128,128,128,1
    28,149,128,128,128,128,128,128,149,128,128,128,128,1
    28,170,128,128,128,128,128,128,149,65,68,68,128,79,7
    8,76,89
120 DATA 128,84,87,79,83,128,170,128,128,128,128,128,128
    ,128,128,170,149,84,72,82,69,69,83,128,61,128,128,57
    ,170,128,128,128,128,128,128,149,128,128,128,128,128
    ,128,149,128,128,128,128,128,170,128,128,128,128,128
    ,128,149
130 DATA 65,68,68,128,79,78,76,89,128,84,72,82,69,69,170
    ,128,128,128,128,128,128,128,128,170,149,70,79,85,82
    ,83,128,128,61,128,49,50,170,128,128,128,128,128,128
    ,149,128,128,128,128,128,128,149,128,128,128,128,128

140 DATA 170,128,128,128,128,128,128,149,65,68,68,128,79
    ,78,76,89,128,70,79,85,82,83,170,128,128,128,128,128
    ,128,128,128,170,149,70,73,86,69,83,128,128,61,128,4
    9,53,170,128,128,128,128,128,128,149,128,128,128,128

150 DATA 128,128,149,128,128,128,128,128,170,128,128,128
    ,128,128,128,149,65,68,68,128,79,78,76,89,128,70,73,
    86,69,83,170,128,128,128,128,128,128,128,128,170,149
    ,83,73,88,69,83,128,128,61,128,49,56,170,128,128,128

160 DATA 128,128,128,149,128,128,128,128,128,128,149,128
    ,128,128,128,128,170,128,128,128,128,128,128,149,65,
    68,68,128,79,78,76,89,128,83,73,88,69,83,170,128,128
    ,128,128,128,128,128,128,170,149,84,79,84,65,76,128,
    128
```

```
170 DATA 61,128,54,51,170,128,128,128,128,128,128,149,12
    8,128,128,128,128,128,149,128,128,128,128,128,170,12
    8,128,128,128,128,128,149,128,128,128,128,128,128,12
    8,128,128,128,128,128,128,128,170,128,128,128,128,12
    8,128,128,128,170
180 DATA 159,143,143,143,143,143,143,143,143,143,143,143
    ,175,128,128,128,128,128,128,149,128,128,128,128,128
    ,128,149,128,128,128,128,128,170,128,128,128,128,128
    ,128,159,143,143,143,143,143,143,143,143,143,143,143
    ,143,143,143,175,128
190 DATA 128,128,128,128,128,128,128,170,149,51,128,79,7
    0,128,65,128,75,73,78,68,170,128,128,128,128,128,128
    ,149,128,128,128,128,128,128,149,128,128,128,128,128
    ,170,128,128,128,128,128,128,149,84,79,84,65,76,128,
    65,76
200 DATA 76,128,68,73,67,69,170,128,128,128,128,128,128,
    128,128,128,170,149,52,128,79,70,128,65,128,75,73,78,68,
    170,128,128,128,128,128,128,149,128,128,128,128,128,
    128,149,128,128,128,128,128,170,128,128,128,128,128,
    128,149
210 DATA 84,79,84,65,76,128,65,76,76,128,68,73,67,69,170
    ,128,128,128,128,128,128,128,128,170,149,70,85,76,76
    ,128,128,72,79,85,83,69,170,128,128,128,128,128,128,
    149,128,128,128,128,128,128,149,128,128,128,128,128
220 DATA 170,128,128,128,128,128,128,149,84,79,84,65,76,
    128,83,67,79,82,69,128,50,53,170,128,128,128,128,128
    ,128,128,128,128,170,149,83,77,46,83,84,82,65,73,71,72,8
    4,170,128,128,128,128,128,128,149,128,128,128,128
230 DATA 128,128,149,128,128,128,128,128,170,128,128,128
    ,128,128,128,149,84,79,84,65,76,128,83,67,79,82,69,1
    28,51,48,170,128,128,128,128,128,128,128,128,170,149
    ,76,71,46,83,84,82,65,73,71,72,84,170,128,128,128
240 DATA 128,128,128,149,128,128,128,128,128,128,149,128
    ,128,128,128,128,170,128,128,128,128,128,128,149,84,
    79,84,65,76,128,83,67,79,82,69,128,52,48,170,128,128
    ,128,128,128,128,128,128,170,149,89,128,65,128,72,12
    8,84
250 DATA 128,90,128,69,170,128,128,128,128,128,128,149,1
    28,128,128,128,128,128,149,128,128,128,128,128,170,1
    28,128,128,128,128,128,149,84,79,84,65,76,128,83,67,
    79,82,69,128,53,48,170,128,128,128,128,128,128,128,1
    28,170
260 DATA 149,67,128,72,128,65,128,78,128,67,128,69,170,1
    28,128,128,128,128,128,149,128,128,128,128,128,128,1
    49,128,128,128,128,128,170,128,128,128,128,128,128,1
    49,84,79,84,65,76,128,65,76,76,128,68,73,67,69,170,1
    28
270 DATA 128,128,128,128,128,128,128,170,149,71,82,65,78
    ,68,128,84,79,84,65,76,170,128,128,128,128,128,128,1
    49,128,128,128,128,128,128,149,128,128,128,128,128,1
    70,128,128,128,128,128,128,149,128,128,128,128,128,1
```

```
    28,128,128
280 DATA 128,128,128,128,128,128,170,176,176,176,176,176
    ,176,176,176,186
290 FOR  M = 15360 TO 16383:
         READ C:
         POKE M,C:
    NEXT :
    GOSUB 50000:
    CLS
300 INPUT "HOW MANY PLAYERS (1-4)";T
305 IF   T < 1 OR T > 4
    THEN CLS :
         GOTO 300 ..........................................
306 CLS
310 FOR  X = 1 TO T:
         PRINT "ENTER INITIALS OF PLAYER #";X;
320      A$ = INKEY$ :
         IF   A$ = ""
         THEN 320 ..........................................
325      IF   A$ = CHR$ (13)
         THEN PRINT :
              NEXT X
330      PRINT A$;
340      N$(X) = N$(X) + A$:
         IF   LEN (N$(X)) = 3
         THEN PRINT :
              NEXT X
350      IF   X < T + 1
         THEN 320 ..........................................
360      GOSUB 50110
410      A = 462:
         FOR  X = 1 TO T:
              PRINT @A,N$(X);:
              A = A + 7:
         NEXT X:
         GOTO 2030 .........................................
-------------------------------------------------------------
425      CLS
430      A1$ = STRING$ (9,191):
         A2$ = STRING$ (9,128)
435      C = 0
440      IF   D1 = 0 PRINT @C,A1$;:
              PRINT @C + 64,A1$;:
              PRINT @C + 128,A1$;
441      PRINT @C + 192,"1";:
         PRINT @67,R1;
445      C = 11
450      IF   D2 = 0 PRINT @C,A1$;:
              PRINT @C + 64,A1$;:
              PRINT @C + 128,A1$;
451      PRINT @C + 192,"2";:
```

```
            PRINT @78,R2;
455         C = 22
460         IF   D3 = Ø PRINT @C,A1$;:
                 PRINT @C + 64,A1$;:
                 PRINT @C + 128,A1$;
461         PRINT @C + 192,"3";:
            PRINT @89,R3;
465         C = 33
470         IF   D4 = Ø PRINT @C,A1$;:
                 PRINT @C + 64,A1$;:
                 PRINT @C + 128,A1$;
471         PRINT @C + 192,"4";:
            PRINT @1ØØ,R4;
475         C = 44
480         IF   D5 = Ø PRINT @C,A1$;:
                 PRINT @C + 64,A1$;:
                 PRINT @C + 128,A1$;
481         PRINT @C + 192,"5";:
            PRINT @111,R5;
489         IF   V1 = 1
            THEN V1 = Ø:
                 GOTO 52Ø ..........................................
490         PRINT @448,"PRESS UP ARROW TO ROLL DICE  "N$(PX
            )
500         I$ = INKEY$ :
            IF   I$ = "["
            THEN GOSUB 3ØØØ:
            ELSE 5ØØ ..........................................
510         PRINT @A,A2$;:
            PRINT @A + 64,A2$;:
            PRINT @A + 128,A2$;:
            PRINT @A + 19Ø,A2$;
520         PRINT @448,"(S)=SAVE DICE  (E)=ENTER SCORE  (R)
            =ROLL AGAIN  (C)=SEE SCORE"
525         TT = TT + 1
530         I$ = INKEY$ :
            IF   I$ = ""
            THEN 53Ø ..........................................
535         IF   TT = 3
            THEN TT = Ø:
                 PRINT "3 ROLL LIMIT":
                 INPUT "PRESS ENTER TO RECORD SCORE";I$:
                 GOSUB 5Ø11Ø:
                 GOTO 199Ø ..........................................
540         IF   I$ = "R"
            THEN 425 ..........................................
550         IF   I$ = "S"
            THEN 6ØØ ..........................................
560         IF   I$ = "E" GOSUB 5Ø11Ø:
                 GOSUB 199Ø:
                 TT = Ø:
```

```
            GOTO 425 ....................................
 565    IF  I$ = "C" GOSUB 50110:
            FOR  X = 1 TO 30000:
                 IF   PEEK (14400) < > 2
                 THEN NEXT X:
                 ELSE X = 0:
                      V1 = 1:
                      TT = TT - 1:
                      GOSUB 50000:
                      GOTO 425 ..............................
-------------------------------------------------------------
 570            GOTO 530 ....................................
-------------------------------------------------------------
 600            PRINT "WHICH DICE DO YOU WANT TO SAVE ? (E
                NTER (R) TO ROLL)"
 610            I$ = "":
                INPUT I$
 630            IF   I$ = "1"
                THEN D1 = 1
 640            IF   I$ = "2"
                THEN D2 = 1
 650            IF   I$ = "3"
                THEN D3 = 1
 660            IF   I$ = "4"
                THEN D4 = 1
 670            IF   I$ = "5"
                THEN D5 = 1
 680            IF   I$ = "R"
                THEN 425 ....................................
 690            GOTO 610 ....................................
-------------------------------------------------------------
1990            IF   PX < = 1
                THEN P = 15373:
                ELSE IF   PX = 2
                     THEN P = 15380:
                     ELSE IF   PX = 3
                          THEN P = 15387:
                          ELSE IF   PX = 4
                               THEN P = 15394
1991            W = P:
                LN = 1
2000            S = 120:
                PRINT @S,"PRESS";:
                S = S + 64:
                PRINT @S,"SPACE";:
                S = S + 64:
                PRINT @S,"TO";:
                S = S + 64:
                PRINT @S,"SCORE";
2001            Q = PEEK (P):
                POKE P,143:
```

```
                FOR  E = 1 TO 50:
                NEXT :
                POKE P,Q
2002            IF   PEEK (14400) = 8
                THEN P = P - 64:
                     LN = LN - 1:
                     IF   LN < 1
                     THEN LN = 1
2003            IF   PEEK (14400) = 16
                THEN P = P + 64:
                     LN = LN + 1:
                     IF   LN > 16
                     THEN LN = 16
2004            IF   P < W
                THEN P = W:
                ELSE IF   P > W + 960
                     THEN P = W + 896
2005            IF   PEEK (14400) = 128 GOTO 4000 ..............
2006            PRINT @P - 15360,"";
2007            GOTO 2001 .....................................
-------------------------------------------------------------------
2030            GOSUB 50000
2041            IF   PX = 1
                THEN S1 = S1 + Z
2042            IF   PX = 2
                THEN S2 = S2 + Z
2043            IF   PX = 3
                THEN S3 = S3 + Z
2044            IF   PX = 4
                THEN S4 = S4 + Z
2045            Z = 0
2046            REM  *** SCORE KEEPER [[[[[[[
2050            CLS :
                PX = PX + 1:
                :
                IF   PX > T
                THEN PX = 1
2060            D1 = 0:
                D2 = 0:
                D3 = 0:
                D4 = 0:
                D5 = 0:
                R1 = 0:
                R2 = 0:
                R3 = 0:
                R4 = 0:
                R5 = 0
2070            H$ = "":
                GOTO 425 ......................................
-------------------------------------------------------------------
3000            PRINT @448,"                                    "
```

```
                ;
3010            A$ = CHR$ (191) + CHR$ (179) + CHR$ (191) +
                CHR$ (140) + STRING$ (60,32) + CHR$ (156) +
                CHR$ (191) + STRING$ (62,32) + CHR$ (131) +
                CHR$ (191) + STRING$ (2,179) + STRING$ (59
                ,32) + CHR$ (156) + CHR$ (140) + CHR$ (143
                ) + CHR$ (32) + CHR$ (143) + CHR$ (140)
3020            B$ = CHR$ (191) + CHR$ (179) + CHR$ (191) +
                CHR$ (140) + STRING$ (60,32) + CHR$ (168) +
                CHR$ (191) + STRING$ (2,176) + STRING$ (61
                ,32) + CHR$ (191) + CHR$ (176) + STRING$ (
                62,32) + STRING$ (2,143) + CHR$ (140)
3030            C$ = CHR$ (191) + CHR$ (179) + CHR$ (191) +
                CHR$ (140) + STRING$ (59,32) + CHR$ (168) +
                CHR$ (140) + CHR$ (191) + STRING$ (2,176) +
                STRING$ (61,32) + CHR$ (191) + STRING$ (2,
                176) + STRING$ (58,32) + CHR$ (143) + STRING$
                (3,131) + CHR$ (32) + CHR$ (143) + CHR$ (1
                40)
3040            D$ = CHR$ (191) + CHR$ (179) + CHR$ (191) +
                CHR$ (140) + STRING$ (60,32) + CHR$ (168) +
                CHR$ (191) + CHR$ (176) + CHR$ (154) + STRING$
                (61,32) + CHR$ (191) + CHR$ (176) + STRING$
                (60,32) + CHR$ (143) + STRING$ (2,131) + CHR$
                (191) + CHR$ (176)
3050            A = 704
3055            IF   PEEK (14400) < > 8
                THEN RETURN  ....................................
3060            PRINT @A,A$:
                PRINT @A,"       ":
                A = A + 1
3065            R = RND (6):
                IF   D1 = 0 PRINT @67,R;:
                     R1 = R
3070            PRINT @A,B$:
                PRINT @A,"       ":
                :
                A = A + 1
3075            R = RND (6):
                IF   D2 = 0 PRINT @78,R;:
                     R2 = R
3080            PRINT @A,C$:
                PRINT @A,"       ":
                A = A + 1
3085            R = RND (6):
                IF   D3 = 0 PRINT @89,R;:
                     R3 = R
3090            B = A
3095            R = RND (6):
                IF   D4 = 0 PRINT @100,R;:
                     R4 = R
```

```
3100            PRINT @A,D$:
                PRINT @A,"       ":
                A = A + 1
3105            R = RND (6):
                IF   D5 = 0 PRINT @111,R;:
                     R5 = R
3110            IF   A > 755 RETURN  .........................
3120            GOTO 3055 ....................................
-------------------------------------------------------------
4000            PRINT @184,"CLEAR";:
                PRINT @312,"PLAY ";
4005            PRINT @P - 15360,"";
4006            IF   PEEK (P + 2) < > 128
                THEN 2000 ....................................
4010            ON LN GOTO 5000,6000,7000,8000,9000,10000,
                4020,4020,11000,12000,13000,14000,15000 ........
-------------------------------------------------------------
4020            IF   LN = 14
                THEN 16000: ..................................
                ELSE IF   LN = 15
                     THEN 17000 ..............................
4030            GOTO 2000 ....................................
-------------------------------------------------------------
4040            '  :::::::::::::::::::: ONES
5000            IF   R1 = 1Z = Z + 1
5010            IF   R2 = 1Z = Z + 1
5020            IF   R3 = 1Z = Z + 1
5030            IF   R4 = 1Z = Z + 1
5040            IF   R5 = 1Z = Z + 1
5060            GOTO 18000 ...................................
-------------------------------------------------------------
5070            '  :::::::::::::::::::: TWOS
6000            IF   R1 = 2Z = Z + 2
6010            IF   R2 = 2Z = Z + 2
6020            IF   R3 = 2Z = Z + 2
6030            IF   R4 = 2Z = Z + 2
6040            IF   R5 = 2Z = Z + 2
6060            GOTO 18000 ...................................
-------------------------------------------------------------
6070            '  :::::::::::::::::::: THREES
7000            IF   R1 = 3Z = Z + 3
7010            IF   R2 = 3Z = Z + 3
7020            IF   R3 = 3Z = Z + 3
7030            IF   R4 = 3Z = Z + 3
7040            IF   R5 = 3Z = Z + 3
7050            GOTO 18000 ...................................
-------------------------------------------------------------
7060            '  :::::::::::::::::::: FOURS
8000            IF   R1 = 4Z = Z + 4
8010            IF   R2 = 4Z = Z + 4
8020            IF   R3 = 4Z = Z + 4
```

```
 8030          IF   R4 = 4Z = Z + 4
 8040          IF   R5 = 4Z = Z + 4
 8050          GOTO 18000 ....................................
-------------------------------------------------------------
 8060          '  :::::::::::::::::::: FIVES
 9000          IF   R1 = 5Z = Z + 5
 9010          IF   R2 = 5Z = Z + 5
 9020          IF   R3 = 5Z = Z + 5
 9030          IF   R4 = 5Z = Z + 5
 9040          IF   R5 = 5Z = Z + 5
 9050          GOTO 18000 ....................................
-------------------------------------------------------------
 9060          '  :::::::::::::::::::: SIXES
10000          IF   R1 = 6Z = Z + 6
10010          IF   R2 = 6Z = Z + 6
10020          IF   R3 = 6Z = Z + 6
10030          IF   R4 = 6Z = Z + 6
10040          IF   R5 = 6Z = Z + 6
10050          GOTO 18000 ....................................
-------------------------------------------------------------
10060          '  :::::::::::::::::::: 3 OF A KIND
11000          FOR  X = 1 TO 6
11010               IF   R1 = X
                    THEN Z = Z + 1
11020               IF   R2 = X
                    THEN Z = Z + 1
11030               IF   R3 = X
                    THEN Z = Z + 1
11040               IF   R4 = X
                    THEN Z = Z + 1
11050               IF   R5 = X
                    THEN Z = Z + 1
11060               IF   Z > = 3
                    THEN Z = R1 + R2 + R3 + R4 + R5:
                         GOTO 18000 ...........................
11070               Z = 0:
               NEXT X:
               Z = 0:
               GOTO 18000 ....................................
-------------------------------------------------------------
11080          '  :::::::::::::::::::: 4 OF A KIND
12000          FOR  X = 1 TO 6
12010               IF   R1 = X
                    THEN Z = Z + 1
12020               IF   R2 = X
                    THEN Z = Z + 1
12030               IF   R3 = X
                    THEN Z = Z + 1
12040               IF   R4 = X
                    THEN Z = Z + 1
12050               IF   R5 = X
```

```
                    THEN Z = Z + 1
12060               IF   Z > = 4
                    THEN Z = R1 + R2 + R3 + R4 + R5:
                         GOTO 18000 ..........................
12070               Z = 0:
               NEXT X:
               Z = 0:
               GOTO 18000 ....................................
-------------------------------------------------------------------
12080          '  :::::::::::::::::::: FULL HOUSE
13000          FOR  X = 1 TO 6
13010               IF   R1 = X
                    THEN Z = Z + 1:
                         E1 = 1
13020               IF   R2 = X
                    THEN Z = Z + 1:
                         E2 = 1
13030               IF   R3 = X
                    THEN Z = Z + 1:
                         E3 = 1
13040               IF   R4 = X
                    THEN Z = Z + 1:
                         E4 = 1
13050               IF   R5 = X
                    THEN Z = Z + 1:
                         E5 = 1
13060               IF   Z = 3
                    THEN Z = 0:
                         GOTO 13080 ..........................
13070               Z = 0:
                    E1 = 0:
                    E2 = 0:
                    E3 = 0:
                    E4 = 0:
                    E5 = 0:
               NEXT X:
               Z = 0:
               GOTO 18000 ....................................
-------------------------------------------------------------------
13080          FOR  X = 1 TO 6
13090               IF   E1 = 0 AND R1 = X
                    THEN Z = Z + 1
13100               IF   E2 = 0 AND R2 = X
                    THEN Z = Z + 1
13110               IF   E3 = 0 AND R3 = X
                    THEN Z = Z + 1
13120               IF   E4 = 0 AND R4 = X
                    THEN Z = Z + 1
13130               IF   E5 = 0 AND R5 = X
                    THEN Z = Z + 1
13140               IF   Z = 2
```

```
                    THEN Z = 25:
                         GOTO 18000 ..........................
13150               Z = 0:
               NEXT X:
               Z = 0:
               GOTO 18000 ..................................
-------------------------------------------------------------
13160          '  :::::::::::::::::::: SMALL STRAIGHT
14000          X = 1
14010          IF   R1 = X
               THEN X = X + 1:
                    GOTO 14010 .............................
14020          IF   R2 = X
               THEN X = X + 1:
                    GOTO 14010 .............................
14030          IF   R3 = X
               THEN X = X + 1:
                    GOTO 14010 .............................
14040          IF   R4 = X
               THEN X = X + 1:
                    GOTO 14010 .............................
14050          IF   R5 = X
               THEN X = X + 1:
                    GOTO 14010 .............................
14060          IF   X > = 5
               THEN Z = 30:
                    GOTO 18000 .............................
14080          IF   X = 1
               THEN X = 2:
                    GOTO 14010 .............................
14090          Z = 0:
               GOTO 18000 ..................................
-------------------------------------------------------------
14150          '  :::::::::::::::::::: LARGE STRAIGHT
15000          X = 1
15010          IF   R1 = X
               THEN X = X + 1:
                    GOTO 15010 .............................
15020          IF   R2 = X
               THEN X = X + 1:
                    GOTO 15010 .............................
15030          IF   R3 = X
               THEN X = X + 1:
                    GOTO 15010 .............................
15040          IF   R4 = X
               THEN X = X + 1:
                    GOTO 15010 .............................
15050          IF   R5 = X
               THEN X = X + 1:
                    GOTO 15010 .............................
15060          IF   X > = 6
```

```
                IF   EN = T * 13
                THEN 19000 ....................................
18100           IF   PEEK (14400) = 2
                THEN 2030: ....................................
                ELSE 18100 ....................................
-------------------------------------------------------------------
19000           IF   Z1 > = 63
                THEN Z1 = Z1 + 35
19010           IF   Z2 > = 63
                THEN Z2 = Z2 + 35
19020           IF   Z3 > = 63
                THEN Z3 = Z3 + 35
19030           IF   Z4 > = 63
                THEN Z4 = Z4 + 35
19040           IF   Z1 > 0 PRINT @397,Z1;:
                     PRINT @973,Y1 + Z1;
19050           IF   Z2 > 0 PRINT @404,Z2;:
                     PRINT @980,Y2 + Z2;
19060           IF   Z3 > 0 PRINT @411,Z3;:
                     PRINT @987,Y3 + Z3;
19070           IF   Z4 > 0 PRINT @418,Z4;:
                     PRINT @994,Y4 + Z4;
19080           GOTO 19080 ....................................
-------------------------------------------------------------------
50000           '            BLOCKMOVE TO MEMORY SUBROUTINE

50010           ZZ = PEEK (16634) * 256 + PEEK (16633) + 1
                000
50020           ZY = ZZ + 12:
                MS = INT (ZY / 256):
                LS = ZY - MS * 256
50030           IF   ZZ > 32767
                THEN ZY = - 1 * (65536 - ZZ):
                     ZZ = ZY
50040           POKE ZZ,17:
                POKE ZZ + 1,LS:
                POKE ZZ + 2,MS:
                POKE ZZ + 3,33:
                POKE ZZ + 4,0
50050           POKE ZZ + 5,60:
                POKE ZZ + 6,1:
                POKE ZZ + 7,0:
                POKE ZZ + 8,4
50060           POKE ZZ + 9,237:
                POKE ZZ + 10,176:
                POKE ZZ + 11,201
50070           MS = INT (ZZ / 256):
                LS = ZZ - MS * 256
50080           IF   PEEK (16396) = 201
                THEN POKE 16526,LS:
                     POKE 16527,MS
```

```
                THEN Z = 40:
                     GOTO 18000 ..............................
15070           IF   X = 1
                THEN X = X + 1:
                     GOTO 15010 ..............................
15080           Z = 0:
                GOTO 18000 ..................................
-------------------------------------------------------------
15090           '  :::::::::::::::::::: YAHTZEE
16000           FOR  X = 1 TO 6
16010                IF   R1 = X
                     THEN Z = Z + 1
16020                IF   R2 = X
                     THEN Z = Z + 1
16030                IF   R3 = X
                     THEN Z = Z + 1
16040                IF   R4 = X
                     THEN Z = Z + 1
16050                IF   R5 = X
                     THEN Z = Z + 1
16060                IF   Z = 5
                     THEN Z = 50:
                          GOTO 18000 .........................
16070                Z = 0:
                NEXT X:
                GOTO 18000 ..................................
-------------------------------------------------------------
16130           '  :::::::::::::::::::: CHANCE
17000           Z = R1 + R2 + R3 + R4 + R5
18000           IF   PEEK (P + 2) < > 128
                THEN 2000 ...................................
18005           W$ = "###":
                PRINT USING W$;Z;
18010           IF   PX = 1 AND P < 15821
                THEN Z1 = Z1 + Z
18020           IF   PX = 2 AND P < 15828
                THEN Z2 = Z2 + Z
18030           IF   PX = 3 AND P < 15835
                THEN Z3 = Z3 + Z
18040           IF   PX = 4 AND P < 15842
                THEN Z4 = Z4 + Z
18050           IF   PX = 1 AND P > 15821
                THEN Y1 = Y1 + Z
18060           IF   PX = 2 AND P > 15828
                THEN Y2 = Y2 + Z
18070           IF   PX = 3 AND P > 15835
                THEN Y3 = Y3 + Z
18080           IF   PX = 4 AND P > 15842
                THEN Y4 = Y4 + Z
18090           TT = 0:
                EN = EN + 1:
```

```
50090           DEF USR 0 = ZZ:
                A = USR (0)
50100           RETURN  ..........................................
-----------------------------------------------------------------
50110           '            BLOCKMOVE TO SCREEN SUBROUTINE

50120           POKE ZZ + 4, PEEK (ZZ + 1):
                POKE ZZ + 5, PEEK (ZZ + 2)
50130           POKE ZZ + 1,0:
                POKE ZZ + 2,60:
                A = USR (0):
                RETURN  ..........................................
-----------------------------------------------------------------
```

8

Working With Strings

If you learn to work with string capablities, you'll gain a better understanding of how to use your computer to its best advantage. Without strings, your computer is just an overgrown calculator.

Let's try some string manipulation. Type in the following lines of code.

```
0 CLEAR 100
10 A$="NOW IS THE TIME FOR ALL GOOD MEN"
```

If we want to pull the word "NOW" out of this string, we can add the following line.

```
20 PRINTLEFT$(A$,3)
```

To pull the word "IS" out, we can use:

```
30 PRINTMID$(A$,5,2)
```

To pull the rest of the line out, we can use:

```
40 PRINTRIGHT$(A$,25)
```

Suppose we want to remove all the spaces from the string. We could use the following code:

```
50 FORX=1TOLEN(A$):IFMID$(A$,X,1)=" "THENNEXTELSEPRINT
MID$(A$,X,1);:NEXT:PRINT
```

We can even print the line *backwards* by using the following code:

```
60 FORX=LEN(A$)TO1STEP-1:PRINTMID$(A$,X,1);:NEXT:PRINT
```

We can change the composition of the string with this line:

```
70 PRINTRIGHT$(A$,25);:PRINTMID$(A$,4,4);:PRINTLEFT$(A$,3)
```

Now type in the following line:

```
80 B$="  ":MID$(A$,12,4)=B$:PRINTA$
```

You can do a great deal using strings. The best way to learn is by playing with them, just as we did in the lines above. Keep trying different things, you can't hurt anything and you never know what you might learn!

The following one-liner prints a calendar for any year you wish. The variable (S) equals the print position for the first day of the year. You'll have to adjust M$ yourself for leap years. When you type this line in, you may have to go into the editing mode to make it all fit!

```
50000
M$="JAN31FEB28MAR31APR30MAY31JUN30JUL31AUG31SEP30OCT31
NOV30DEC31":D$="SUN MON TUE WED THR FRI SAT":S=20:FORX
=1TOLEN(M$)STEP5:PRINTMID$(M$,X,3):PRINTD$:FORZ=1TOVAL
(MID$(M$,X+3,2)):IFS=24THENPRINTTAB(S)Z:S=0:NEXTZ,XELSE
PRINTTAB(S)Z;:S=S+4:NEXTZ:PRINT:NEXTX
```

One nice feature about string packing is that you don't have to clear any string space in your program because the graphics are actually contained in the program lines and not in memory reserved for strings.

What we are actually doing is defining a string to be a certain length in our program. This string reserves that area of memory for us to use as we wish. By POKEing a memory space with graphic codes, we replace it with graphics characters which the computer converts into keywords it can understand.

This is why the listing looks so strange. If we wanted to make the effort, we could unpack these lines with the following code:

```
FOR X=1 TO LEN(A$):PRINT ASC(MID$(A$,X,1);:NEXT X
```

The variable A$ can be any string you wish to unpack.

An explanation of the GRAPHICS PACKER utility program (Auto/Graphics Compiler) follows. This utility program will be used for other games in the book, and we recommend that you type it in before going much further.

AUTO/GRAPHICS Compiler

Stop typing A$=CHR$(191)+CHR$(178)+ETC+ETC+ETC! It's time we started writing programs that let our computers do all the work for us, — or at least *some* of the more time-consuming work in programming.

With AUTO/GRAPHICS, all you need to do is draw the picture you want (a background for your game program, for example). You don't have to worry about how big the picture is when it's time to save it; the computer will convert your picture into packed string$ in about 30 seconds.

How to Use AUTO/GRAPHICS

When you load the program and type RUN, the name will appear on the screen. Press the (enter) key to begin.
We start out in the move mode, with the following controls available to us:

(D)	= GOTO DRAW MODE
(E)	= ERASE MODE
(M)	= MOVE MODE
(S)	= SAVE PICTURE
(CLEAR KEY)	= CLEAR SCREEN
(ENTER)	= GOTO PRINT MODE

In the drawing mode, we have the following extra options:

(F)	= GOTO FINE LINE MODE
(SPACE BAR)	= ERASE OR MOVE MODE

In the print mode, the cursor will stop flashing and you can enter any text you wish to your graphics. To exit from this mode, press enter and you will return to the move mode.

If you press the (S) key while in the move mode, the computer will convert your picture into string$. After this is done, the screen will clear and say READY. To see your new program, type LIST (enter). You may now save this picture on tape. If you want to see the picture again, add the lines below and run.

Figure 8.1 *Additional Program Lines*

```
1060 CLS:PRINT A1$;A2$;A3$;A4$;A5$;A6$;
1070 GOTO 1070
```

Remember not to edit these lines. If you decide to add or make changes to the program, you'll have to adjust line 800 to give the new starting position in memory. To find that information, enter the lines below.

Figure 8.2 *Additional Program Lines*

```
2000 A=17129
2010 B=PEEK(A)
2020 PRINT A;B;CHR$(B)
2030 IFPEEK(14400)=8THENA=A+1:GOTO2010
2040 IFPEEK(14400)=16THENA=A-1:GOTO2010
2050 GOTO 2030
```

Program Explanation

Lines 10 and 20 clear the screen and convert over to the 32-character print mode.

Line 40 starts our inkey$ strobe. As soon as any character is found, it lets our program continue. The name will remain on the screen until the operator starts pushing buttons. This method is fine if you have used the program before, but it can be a little confusing otherwise.

Line 50 clears the screen and initalizes (A) for our screen starting position. When you begin using PEEKS and POKES, you have to keep the variables under complete control at all times or your program might self-destruct.

Line 60 is where we first PEEK location (A), enabling us to move around the screen, run over our drawings and then replace those locations with the values that were originally there.

Line 70 may look a little strange, but it is very important. This gives the last position of our cursor and puts us back on the screen if we are about to run off.

Lines 80 to 190 check the keyboard for a control key that would route to a different area of the program and also move the cursor in the direction we want. Lines 200 to 530 also repeat this function.

Line 710 is a fast way to convert POKE positions into PRINT positions. Take the POKE position minus 15360 and we obtain the same screen position in PRINT @ values.

When you see A1$="XXXXXXXXXXXXXXXXXX," use the address of the first X for the value of A in line 800; then you can delete lines 2000 to 2050 and you're ready to go.

Figure 8.3 *Graphics Packer (AUTOGRAF) Program*

```
 10 CLS
 20 PRINT CHR$ (23)
 30 PRINT @456,"AUTO/GRAPHICS COMPILER"
 40 A$ = INKEY$ :
    IF   A$ = ""
    THEN 40 ..................................................
 50 CLS :
    A = 15360
 60 B = PEEK (A):
    POKE A,191:
    FOR  X = 1 TO 5:
    NEXT :
    POKE A,B
 70 C = A
 80 IF   PEEK (14400) = 1 GOSUB 700
100 IF   PEEK (14400) = 8
    THEN A = A - 64
110 IF   PEEK (14400) = 16
    THEN A = A + 64
120 IF   PEEK (14400) = 32
    THEN A = A - 1
130 IF   PEEK (14400) = 64
    THEN A = A + 1
140 IF   PEEK (14337) = 16
    THEN GOSUB 200
150 IF   PEEK (14340) = 8
    THEN GOTO 800 ..................................................
160 IF   A < 15360 OR A > 16382
    THEN A = C
170 IF   PEEK (14400) = 2
    THEN CLS
180 B = PEEK (A):
    POKE A,128:
    POKE A,B
190 GOTO 60
-------------------------------------------------------------------
200 L = 191
210 POKE A,L
220 C = A
230 IF   PEEK (14400) = 8
    THEN A = A - 64
240 IF   PEEK (14400) = 16
    THEN A = A + 64
250 IF   PEEK (14400) = 32
    THEN A = A - 1
260 IF   PEEK (14400) = 64
    THEN A = A + 1
270 IF   PEEK (14338) = 32
    THEN RETURN  ..................................................
280 IF   PEEK (14337) = 32
```

```
    THEN L = 128
290 IF   PEEK (14337) = 16
    THEN L = 191
370 IF   A < 15360 OR A > 16382
    THEN A = C
380 IF   PEEK (14337) = 64
    THEN GOTO 400 ..........................................
390 GOTO 210
-------------------------------------------------------------------
400 X = 0:
    Y = 0
410 IF   PEEK (14400) = 8
    THEN Y = Y - 1
420 IF   PEEK (14400) = 16
    THEN Y = Y + 1
430 IF   PEEK (14400) = 32
    THEN X = X - 1
440 IF   PEEK (14400) = 64
    THEN X = X + 1
450 IF   PEEK (14400) = 136 RESET (X,Y):
         Y = Y - 1
460 IF   PEEK (14400) = 144 RESET (X,Y):
         Y = Y + 1
470 IF   PEEK (14400) = 160 RESET (X,Y):
         X = X - 1
480 IF   PEEK (14400) = 192 RESET (X,Y):
         X = X + 1
490 IF   X < 0 OR X > 127
    THEN X = X1
500 IF   Y < 0 OR Y > 47
    THEN Y = Y1
510 SET (X,Y):
    X1 = X:
    Y1 = Y
520 IF   PEEK (14338) = 32 GOTO 60 .........................
530 GOTO 410
-------------------------------------------------------------------
700 REM  ***** PRINT ROUTINE *****
710 I = A - 15360:
    PRINT @I + 1,"";
720 A$ = INKEY$ :
    IF   A$ = ""
    THEN 720 ...............................................
730 IF   A$ = CHR$ (13) RETURN  ............................
740 PRINT A$;:
    A = A + 1
750 GOTO 720
-------------------------------------------------------------------
800 A = 18383
810 FOR  X = 15360 TO 16382
815      IF   X > 15375 PRINT @0,"SAVING DATA ";
```

```
 820      B = PEEK (X)
 830      C = PEEK (A):
          IF   C < > 88
          THEN A = A + 1:
               GOTO 830 ..........................................
 840      IF   C = 88 POKE A,B:
               A = A + 1:
               NEXT X:
               CLS
 850      DELETE 10 - 850
1000      A1$ = "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXX"
1010      A2$ = "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXX"
1020      A3$ = "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXX"
1030      A4$ = "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXX"
1040      A5$ = "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXX"
1050      A6$ = "XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
          XXXXXXXXXXXXXXXXXXXXXXX"
```

DATA/GRAPHICS Compiler

This program works the same way as AUTO/GRAPHICS, but it converts text and graphics on the screen into data lines. Best of all, you can edit them if needed!

I have to confess that I cheated a little on this listing. I wrote a short program to enter all the data lines. Don't feel bad though, — you only have to type them in once, provided you remember to save the program before running it.

Figure 8.4 *DATAGRAF Program*

```
100 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
110 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
120 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
130 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
140 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
150 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
160 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
170 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
180 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
190 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
```

```
200 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
210 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
220 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
230 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
240 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
250 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
260 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
270 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX,XXX
280 DATA XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX,XXX
    ,XXX,XXX,XXX,XXX
1000 CLS
1010 PRINT CHR$ (23)
1020 PRINT @456,"DATA/GRAPHICS COMPILER"
1030 A$ = INKEY$ :
     IF   A$ = ""
     THEN 1030 ..................................................
1040 CLS :
     A = 15360
1050 B = PEEK (A):
```

```
      POKE A,191:
      FOR  X = 1 TO 5:
      NEXT :
      POKE A,B
 1060 C = A
 1070 IF   PEEK (14400) = 1 GOSUB 1450
 1080 IF   PEEK (14400) = 8
      THEN A = A - 64
 1090 IF   PEEK (14400) = 16
      THEN A = A + 64
 1100 IF   PEEK (14400) = 32
      THEN A = A - 1
 1110 IF   PEEK (14400) = 64
      THEN A = A + 1
 1120 IF   PEEK (14337) = 16
      THEN GOSUB 1180
 1130 IF   PEEK (14340) = 8
      THEN GOTO 1510 ..........................................
 1140 IF   A < 15360 OR A > 16383
      THEN A = C
 1150 IF   PEEK (14400) = 2
      THEN CLS
 1160 B = PEEK (A):
      POKE A,128:
      POKE A,B
 1170 GOTO 1050
-------------------------------------------------------------------
 1180 L = 191
 1190 POKE A,L
 1200 C = A
 1210 IF   PEEK (14400) = 8
      THEN A = A - 64
 1220 IF   PEEK (14400) = 16
      THEN A = A + 64
 1230 IF   PEEK (14400) = 32
      THEN A = A - 1
 1240 IF   PEEK (14400) = 64
      THEN A = A + 1
 1250 IF   PEEK (14338) = 32
      THEN RETURN  ............................................
 1260 IF   PEEK (14337) = 32
      THEN L = 128
 1270 IF   PEEK (14337) = 16
      THEN L = 191
 1280 IF   A < 15360 OR A > 16383
      THEN A = C
 1290 IF   PEEK (14337) = 64
      THEN GOTO 1310 ..........................................
 1300 GOTO 1190
-------------------------------------------------------------------
 1310 X = 0:
```

```
      Y = Ø
 1320 IF   PEEK (14400) = 8
      THEN Y = Y - 1
 1330 IF   PEEK (14400) = 16
      THEN Y = Y + 1
 1340 IF   PEEK (14400) = 32
      THEN X = X - 1
 1350 IF   PEEK (14400) = 64
      THEN X = X + 1
 1360 IF   PEEK (14400) = 136 RESET (X,Y):
           Y = Y - 1
 1370 IF   PEEK (14400) = 144 RESET (X,Y):
           Y = Y + 1
 1380 IF   PEEK (14400) = 160 RESET (X,Y):
           X = X - 1
 1390 IF   PEEK (14400) = 192 RESET (X,Y):
           X = X + 1
 1400 IF   X < Ø OR X > 127
      THEN X = X1
 1410 IF   Y < Ø OR Y > 47
      THEN Y = Y1
 1420 SET (X,Y):
      X1 = X:
      Y1 = Y
 1430 IF   PEEK (14338) = 32 GOTO 1050 .....................
 1440 GOTO 1320
-----------------------------------------------------------------
 1450 REM  ***** PRINT ROUTINE *****
 1460 I = A - 15360:
      PRINT @I + 1,"";
 1470 A$ = INKEY$ :
      IF   A$ = ""
      THEN 1470 ..................................................
 1480 IF   A$ = CHR$ (13) RETURN  ...............................
 1490 PRINT A$;:
      A = A + 1
 1500 GOTO 1470
-----------------------------------------------------------------
 1510 S = 15360:
      M = 17129:
      X = Ø
 1520 A = PEEK (S):
      B = PEEK (S + 1):
      C = PEEK (S + 2):
      D = PEEK (S + 3):
      E = PEEK (S + 4)
 1530 IF   A < 128 PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
           PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
           PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
           PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
           PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
```

```
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
```

```
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK PEEK
```

NOTES

9

MAKE A MAZE

This program is called MAKE A MAZE. This time, instead of just showing you the listing of the program to type into your computer, I'm going to show you all the steps that I go through to write a game program. Let's work on this one together from start to finish.

MAKE A MAZE is a game for two players. The idea is for the first player to create a path around the maze for his piece to travel. This is done by pressing the arrow keys for the direction you want to go.

The program stores all these moves in an array for later use. The second player then presses ENTER to start the game. The object for the second player is to move his piece around the maze, hitting the stars for points and at the same time trying to avoid the first player's pieces.

When the game ends, you can either press (S) to repeat the same maze game or press (N) to draw a new maze.

Load GRAPHICS PACKER

The first thing I want you to do is load in the GRAPHICS PACKER program. If you haven't already typed this program in, this would be a good time to do so.

After we have loaded this drawing program, we're going to make a couple of changes to make it easier for you to follow me. First, list the program to make sure it has loaded correctly; then add the following line to the program:

```
525 PRINT@70,"X=";X;"Y=";Y;:PRINT@70," 12 spaces ";
```

This new line will help us to draw exactly the same picture on the screen. After the new line has been entered, type "RUN 1000" <ENTER> in the command mode. The screen should now show the READY sign.

Finding the Starting Address

By running the program starting from line 1000, we let the computer find the new starting address of the lines that will contain our packed strings. Remember, by adding a new line to the program, we have moved the rest of the lines higher up in memory!

Now that the computer knows the new starting address of A1$ in line 1000, we have to find a way of getting this information from the computer. Here comes VARPTR to the rescue.

In the command mode, I want you to type this line:

A=VARPTR(A1$):PRINTPEEK(A+2)*256+PEEK(A+1) <press enter>.

We're doing this not only to find the new address for A1$ but also to make the GRAPHICS PACKER program work for you if you're using a tape or disk system. The reason for this is that the user memory starts at a different address in disk BASIC than it does in a system without disk.

Write down the number you see on your screen and change line 800 to read:

800 A=(number on your screen)

Before we go any further, this would be a good time for you to save this program again, so that you won't have to make these changes the next time you need to use it.

Running GRAPHICS PACKER

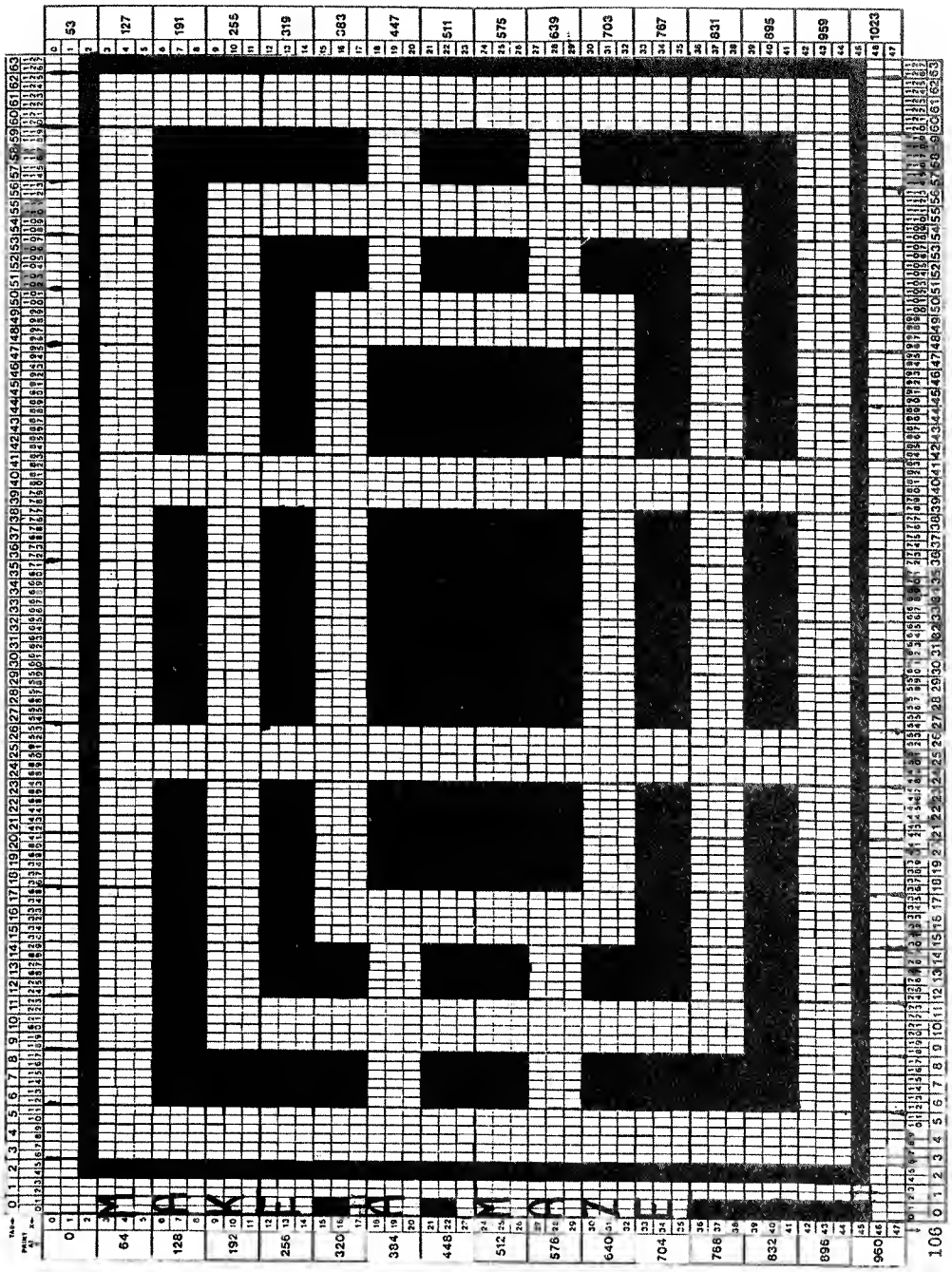
Now we should be ready to run the GRAPHICS PACKER program. When the program starts, you will see the name in the center of the screen. Press the space bar to begin.

You should see a large flashing cursor in the top left corner of the screen, — this is called the move mode of the program. Next, press the (D) key; the cursor should stop flashing and remain on the screen.

Now press the (F) key. This will put us in the fine line drawing mode. To test this out, press the down arrow and draw a line from the top to the bottom of the screen. To erase this line, press the up arrow and space bar at the same time.

With the help of the X,Y coordinates displayed at the top-left corner of your screen and the video display worksheet, I want you to duplicate exactly the MAKE A MAZE picture you see on the worksheet. It's very important that you draw your picture exactly like mine, so take your time and do it right the first time.

Figure 9.1 *MAKE A MAZE Worksheet*



Moving Around the Screen

Remember, to move around on the screen, you press the arrow key for the direction you want to go and the space bar at the same time.

After you have drawn the picture, press the (M) key to go into the main control mode. You should see the large flashing cursor faintly on the screen.

Now press the (S) key to save your graphics and convert them into packed strings. After a few moments, the screen will clear and you should see the READY sign.

Testing the Packed String$

We have now converted our picture into packed strings. Let's add the following lines and run the program so we can test to see if our picture looks the way it should:

```
3060 CLS:PRINTA1$;A2$;A3$;A4$;A5$;A6$;:POKE16383,131
3070 GOTO 3070
```

Now run the program. Wow, it works! If you don't have a nice picture of a MAZE on your screen, start over again. If everything looks okay, delete line 3070 and save this much of the program so that if we mess things up farther down the line, we won't have to draw our picture all over again.

Let's add our sound routine using the string packing method. Add the following lines for our sound:

Figure 9.2 *Sound Routine*

```
100 CLS:DIMM(500)
110 M$="XXXXXXXXXXXXXXXXXXXXXXXXXXX"
120 I=VARPTR(M$):M=PEEK(I+1)+256*PEEK(I+2):Z=M
130 READD:POKEM,D:M=M+1:IFD=201THEN140ELSE130
140 DEFUSR0=Z
150 DATA 205,127,10,77,68,62,1,105,211,255,45,32,253,60
    105,211,255,45,32,253,13,16,238,175,211,255,201
```

Note: For tape systems, change line 140 to read:

```
140 POKE16526,PEEK(I+1):POKE16527,PEEK(I+2)
```

Also, each time you see the USR call A=USR1(NUMBER), leave out the number 1 so it looks like this: A=USR(NUMBER).

Testing the Sound

Now run the program again, and enter the following test in the command mode.

```
FORX=1000TO2000STEP10:A=USR1(X):NEXT
FORX=1000TO2000STEP10:A=USR(X):NEXT   (TAPE USERS)
```

Before you do this, hook up your sound box to the computer. You should hear some sounds.

Now if all systems are go, it's time to save our program again, — just in case!

Program Control

Moving right along, we can now get into the program control section. We have about 99% of our graphics out of the way, and we didn't even have to write one line of code to do it! That's the easy way to program graphics.

Now enter lines 3070 TO 3100 from the listing at the end of this chapter (you don't have to enter the remark lines).

The following is an explanation of what each line does:

3070 Define first player's piece.
3080 Define second player's piece.
3090 Define string for clearing pieces.
3100 Set up starting locations for players.

Now we add lines 3110 to 3170 for the first player to create a maze.

3110 Print first player's piece.
3120 Check if he wants to move up.
3130 Check for move down.
3140 Check for move left.
3150 Check for move right.
3160 If space bar pressed, all done.
3170 Make sure they don't go out of maze.

The following lines (3210 and 3220) save all moves in array M.

3210 If player is pressing a key, save move.
3220 Go back for more.

Now we are ready to start the game, and the second player takes over from here! Add lines 4000 to 4035.

4000 Print both players on screen.
4010 Wait for second player to press enter before starting.
4020 Start array loop for first player's pieces.
4025 Repeat loop if needed.
4030 Print first player's piece number 1 and make noise.
4035 Print first player's piece number 2.

Now add lines 4040 to 4050 to check for players' pieces hitting each other.

4040 If array position 1 is in same location as player 2,
4045 or if reverse array position 2 is same, then end.
4050 Print player number 1.

Lines 4060 to 4090 check whether player 2 makes any moves. Let's add these lines to our program.

4060 Check for move up. If yes, then remove old position.
4070 Check for move down.
4080 Check for move left.
4090 Check for move right.

The following lines place and remove the stars from the playing field. Add lines 4095 to 4120.

4095 If player hits star, then increment point counter.
4100 Keep player in maze.
4110 Random road block and point stars.
4115 Random set and reset road blocks.
4120 End of array loop.

Now we'll insert the last lines for our game. Lines 5000 to 5040 check whether the player wants to play the same game again or start a new game.

5000 Sound end of game noise.
5010 Start INKEY loop.
5020 If player hits (S), then play same game.
5030 If player hits (N), then play new game.
5040 End of INKEY loop.

This game was a lot of fun to write. I hope it gives you a better idea of how I go about writing a graphics game.

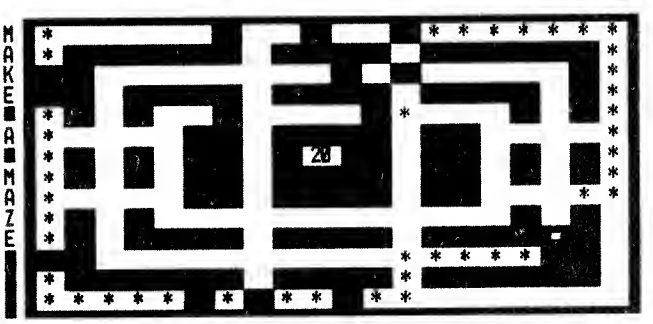


Figure 9.3 *MAKE A MAZE Program*

```
 100 CLS :
     DIM M(500)
 110 M$ = "XXXXXXXXXXXXXXXXXXXXXXXXXXXX"
 120 I = VARPTR (M$):
     M = PEEK (I + 1) + 256 * PEEK (I + 2):
     Z = M
 130 READ D:
     POKE M,D:
     M = M + 1:
     IF   D = 201
     THEN 140: .....................................................
     ELSE 130 .....................................................
-------------------------------------------------------------------
 140 DEF USR 0 = Z
 150 DATA 205,127,10,77,68,62,1,105,211,255,45,32,253,60,
     105,211,255,45,32,253,13,16,238,175,211,255,201
 995 REM  ============================
          PACKED STRINGS FOR MAZE GAME
          ============================
1000 A1$ = " END END DEF DEF DEF DEF DEF DEF DEF DEF DEF
     DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF
     DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF
     DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF
     DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF DEF
     DEF M END USING END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END USING
     A END USING END END END USING USING USING USING USING
     USING USING USING USING USING USING USING USING USING
     USING USING USING USING END END END USING USING USING
     USING USING USING USING USING USING USING USING USING
     END END END USING USING USING USING USING USING USING
     USING USING USING USING USING USING USING USING USING
     USING USING END END END USING "
1010 A2$ = "K END USING END END END USING USING USING END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END USING USING USING END
     END END USING E END USING END END END USING USING USING
     END END END USING USING USING USING USING USING USING
     USING USING USING USING USING END END END USING USING
     USING USING USING USING USING USING USING USING USING
     USING END END END USING USING USING USING USING USING
     USING USING USING USING USING USING END END END USING
     USING USING END END END USING IF   END USING END END
          END USING USING USING END END END USING USING USING
          END END END END END END END END END END END END
```

```
            END END END END END END END END END END END
            END END END END END END END END END END END
            USING USING USING END END END USING USING USING
            END END END USING "
1020 A3$ = "A END USING END END END END END END END END
     END END END END END END USING USING USING USING USING
     USING END END END USING USING USING USING USING USING
     USING USING USING USING USING USING END END END USING
     USING USING USING USING USING END END END END END END
     END END END END END END END END END USING IF   END USING
            END END END USING USING USING END END END USING
            USING USING END END END USING USING USING USING
            USING USING END END END USING USING USING USING
            USING USING USING USING USING USING USING USING
            END END END USING USING USING USING USING USING
            END END END USING USING USING END END END USING
            USING USING END END END USING M END USING END END
            END USING USING USING END END END USING USING USING
            END END END USING USING USING USING USING USING
            END END END USING USING USING USING USING USING
            USING USING USING USING USING USING END END END
            USING USING USING USING USING USING END END END
            USING USING USING END END END USING USING USING
            END END END USING "
1030 A4$ = "A END USING END END END END END END END END
     END END END END END END USING USING USING USING USING
     USING END END END USING USING USING USING USING USING
     USING USING USING USING USING USING END END END USING
     USING USING USING USING USING END END END END END END
     END END END END END END END END END USING Z END USING
     END END END USING USING USING END END END USING USING
     USING END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END USING USING
     USING END END END USING USING USING END END END USING
     E END USING END END END USING USING USING END END END
     USING USING USING USING USING USING USING USING USING
     USING USING USING END END END USING USING USING USING
     USING USING USING USING USING USING USING USING END
     END END USING USING USING USING USING USING USING USING
     USING USING USING USING END END END USING USING USING
     END END END USING "
1040 A5$ = " USING END USING END END END USING USING USING
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END END END END END
     END END END END END END END END USING USING USING
     END END END USING USING END USING END END END USING
     USING USING USING USING USING USING USING USING USING
     USING USING USING USING USING USING USING USING END
     END END USING USING USING USING USING USING USING USING
```

```
     USING USING USING USING END END END USING USING USING
     USING USING USING USING USING USING USING USING USING
     USING USING USING USING USING USING END END END USING
     USING END USING END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END END END
     END END END END END END END END END END END USING
     "
1050 A6$ = " SET END SET SET SET SET SET SET SET SET SET
     SET SET SET SET SET SET SET SET SET SET SET SET SET
     SET SET SET SET SET SET SET SET SET SET SET SET SET
     SET SET SET SET SET SET SET SET SET SET SET SET SET
     SET SET SET SET SET SET SET SET SET SET SET SET SET
     "
3060 CLS :
     PRINT A1$;A2$;A3$;A4$;A5$;A6$;:
     POKE 16383,131
3065 REM  ==============================
               DEFINE STRING$ FOR GAME PIECES
               ==============================
3070 P1$ = CHR$ (191) + CHR$ (191) + CHR$ (191)
3080 P2$ = CHR$ (191) + CHR$ (179) + CHR$ (191)
3090 C$ = CHR$ (128) + CHR$ (128) + CHR$ (128)
3100 P1 = 67:
     P2 = 956:
     E = 67
3105 REM  ==============================
               FIRST PLAYER MAKES A MAZE
               ==============================
3110 PRINT @P1,P1$;:
     FOR  Q = 1 TO 10:
     NEXT Q:
     PRINT @P1,C$;:
     Z = P1
3120 IF   PEEK (14400) = 8
     THEN P1 = P1 - 64
3130 IF   PEEK (14400) = 16
     THEN P1 = P1 + 64
3140 IF   PEEK (14400) = 32
     THEN P1 = P1 - 3
3150 IF   PEEK (14400) = 64
     THEN P1 = P1 + 3
3160 IF   PEEK (14400) = 1
     THEN 4000: ..............................................
     ELSE IF   I = 1
          THEN 4000 ..........................................
3170 IF   PEEK (15360 + P1) < > 128
     THEN P1 = Z
3185 REM  ==============================
               SAVE MOVES IN ARRAY (M)
```

```
                  ==============================
3210 IF    PEEK (14591) > 0
     THEN M(T) = P1:
          T = T + 1:
          IF   T = 500
          THEN 4000 ..............................................
-------------------------------------------------------------------------
3220 GOTO 3110
-------------------------------------------------------------------------
3225 REM  ==============================
               START OF GAME / SECOND PLAYER
               ==============================
4000 PRINT @P2,P2$;:
     PRINT @P1,P1$;
4010 IF    PEEK (14400) < > 1
     THEN 4010 ..............................................
4020 FOR   X = 1 TO T:
           IF   M(X) < 67
           THEN M(X) = 67
4025       O = T - X:
           IF   O = 0
           THEN O = T
4030       PRINT @M(X),P1$;:
           A = USR 0(1111)
4035       PRINT @M(O),P1$;
4038       REM  ==============================
                    CHECK IF PIECES HIT EACH OTHER
                    ==============================
4040       IF   M(X) = P2
           THEN 5000 ..............................................
4045       IF   M(O) = P2
           THEN 5000 ..............................................
4050       PRINT @P2,P2$;:
           Z = P2
4055       REM  ==============================
                    CHECK IF PLAYER MOVES AROUND
                    ==============================
4060       IF   PEEK (14400) = 8
           THEN PRINT @P2,C$;:
                P2 = P2 - 64
4070       IF   PEEK (14400) = 16
           THEN PRINT @P2,C$;:
                P2 = P2 + 64
4080       IF   PEEK (14400) = 32
           THEN PRINT @P2,C$;:
                P2 = P2 - 3
4090       IF   PEEK (14400) = 64
           THEN PRINT @P2,C$;:
                P2 = P2 + 3
4092       REM  ==============================
                    PRINT & REMOVE POINT STARS
```

```
                    ==============================
4095        IF    PEEK (15361 + P2) = 42A = USR Ø(1919):
                  H = H + 1Ø:
                  PRINT @478,H;:
                  GOTO 411Ø ..........................................
4100        IF    PEEK (1536Ø + P2) < > 128
            THEN P2 = Z
4110        R = RND (1Ø):
            IF    R = 5
            THEN PRINT @M(X),P1$;:
                  A = USR Ø(2222):
            ELSE PRINT @M(X)," * ";
4115        R = RND (1Ø):
            IF    R = 5
            THEN PRINT @M(O),P1$;:
            ELSE PRINT @M(O), STRING$ (3,128);
4120 NEXT X:
     GOTO 4020
-------------------------------------------------------------------------------
4125 REM  ==============================
               PLAY AGAIN ? SAME OR NEW GAMES
               ==============================
5000 A = USR Ø(Ø)
5010 I$ = INKEY$
5020 IF    I$ = "S"
     THEN I = 1:
          H = Ø:
          GOTO 3Ø6Ø ..........................................
5030 IF    I$ = "N"
     THEN RUN  ..........................................
5040 GOTO 5010
-------------------------------------------------------------------------------
```

Program Explanation

Lines 10 to 80 are the instructions.
Lines 90 to 110 get input from the players.
Lines 140 to 180 LISA also does math problems for you.
Lines 200 to 250 are the string reader.
Lines 260 to 590 are questions and answers.

LISA

This is my own version of the ELIZA program that is so popular. Instead of being a head doctor, this program acts more like a friend. The program breaks the player's input down into single words. It then looks for a match for these words in its own data. I kept this listing short for the simple reason that the game is more fun when you add your own data lines. You could put in some information about some of your own friends.

Figure 9.4 *LISA Program*

```
 10 REM  *** LISA
 20 REM  *** WRITTEN BY TOM DEMPSEY
 30 CLS :
    PRINT "LISA WILL TALK TO YOU : WHEN YOU ASK A QUESTI
    ON"
 40 PRINT "ALWAYS PUT A SPACE AND A PERIOD AT THE END OF
     YOUR QUESTION.."
 50 PRINT "IF YOU WANT LISA TO ASK YOU A QUESTION TYPE,
    ASK ME A QUESTION ."
 60 INPUT "HIT ENTER TO PLAY";A$
 70 CLS
 80 CLEAR 100
 90 INPUT "WHAT IS YOUR NAME";N$
100 X = 1:
    PRINT " "
110 INPUT "QUESTION";A$
120 IF   A$ = "WHAT IS MY NAME ." PRINT "YOUR NAME IS ";
         N$:
         GOTO 100 ..........................................
130 IF   A$ = "DO YOU KNOW MY NAME ." PRINT "YES":
         GOTO 100 ..........................................
140 IF   A$ = "ASK ME A QUESTION ." GOTO 410 ................
150 IF   A$ = "+":
         INPUT A,B:
         PRINT A + B:
         GOTO 100 ..........................................
160 IF   A$ = "/":
         INPUT A,B:
         PRINT A / B:
         GOTO 100 ..........................................
170 IF   A$ = "*":
         INPUT A,B:
         PRINT A * B:
         GOTO 100 ..........................................
180 IF   A$ = "-":
         INPUT A,B:
         PRINT A - B:
         GOTO 100 ..........................................
190 IF   A$ = "GOOD BYE" PRINT "GOOD BYE ";N$:
         END  ..............................................
200 D = LEN (A$)
210 B$ = MID$ (A$,X,1)
220 X = X + 1:
    IF   X > D
    THEN 100 ..............................................
230 IF   ASC (B$) = 32 GOTO 260 ............................
240 LET D$ = D$ + B$
250 GOTO 210
-------------------------------------------------------------
260 IF   D$ = "WHAT" PRINT "IT'S  ";
```

```
270 IF   D$ = "MEMORY" PRINT MEM :
         GOTO 100 ..........................................
280 IF   D$ = "NAME" PRINT "LISA ";
290 IF   D$ = "OLD" PRINT "3 MONTHS ";
300 IF   D$ = "AGE" PRINT "3 MONTHS ";
310 IF   D$ = "DO" AND X < 5
    THEN R = RND (2):
         IF   R = 1 PRINT "YES ";:
         ELSE PRINT "NO ";
320 IF   D$ = "TIME" PRINT "TIME ";
330 IF   D$ = "ARE" AND X < 6 PRINT "YES ";
340 IF   D$ = "COST" PRINT "TOO MUCH ";N$
350 IF   D$ = "FEEL" PRINT "O.K.";
360 IF   D$ = "HELL" PRINT "PLEASE DON'T USE WORDS LIKE
         THAT ";N$
370 IF   D$ = "LEVEL" PRINT "LEVEL 2 ";
380 IF   D$ = "EAT" PRINT "FOOD "
390 IF   D$ = "FOOD" PRINT "CALLED ELECTRICITY ";N$
400 D$ = "":
    B$ = MID$ (W$,1):
    GOTO 210
-----------------------------------------------------------------
410 R = RND (10)
420 IF   R = 1 PRINT "HOW OLD ARE YOU ";N$
430 IF   R = 2 PRINT "DO YOU HAVE ANY HOBBIES"
440 IF   R = 3 PRINT "DO YOU LIKE GIRLS"
450 IF   R = 4 PRINT "DO YOU LIKE BOYS"
460 IF   R = 5 PRINT "DO YOU LIKE COMPUTERS ";N$
470 IF   R = 6 PRINT "WHAT IS YOUR FAVORITE SPORT ";N$
480 IF   R = 7 PRINT "WHAT TOWN DO YOU LIVE IN ";N$
490 IF   R = 8 PRINT "DO YOU LIKE TO FOOL AROUND ";N$
500 IF   R = 9 PRINT "DO YOU PLAY GOLF ";N$
510 IF   R = 10 PRINT "DO YOU THINK MY RESPONSES ARE GOO
         D ";N$
520 INPUT A$
530 IF   A$ = "YES" PRINT "THATS GOOD":
         GOTO 560 ..........................................
540 IF   A$ = "NO" PRINT "THATS TOO BAD":
         GOTO 560 ..........................................
550 PRINT "THATS NICE"
560 PRINT "WANT ME TO ASK MORE QUESTIONS";
570 INPUT A$
580 IF   A$ = "YES" GOTO 410 ..................................
590 GOTO 100
-----------------------------------------------------------------
```

NOTES

10

Graphic Art and Computers

This chapter contains programs that make use of the video screen as a canvas. It gives examples of what can be done using low resolution.

1932 FORD ROADSTER

The 1932 FORD ROADSTER is not a game, but it is a good example of what can be done with graphics on the TRS-80 computer. The program starts by printing a 1932 FORD ROADSTER on the screen and then transfers the screen contents to your line printer. Afterwards, the program lists itself.

The original version of this program allowed you to press the up arrow key after printing the car on the screen, causing the wheels to turn around, the horn to beep and the radiator to boil over, — shooting steam up to the top of the screen.

There's an unlimited number of things you can do with what first appears to be a stationary object. All you need is a little imagination and a lot of time. This car took three 14-hour days to complete.

I think the effort was worth it. It was published in Interface Age Magazine in February, 1981. I included it in this book because I think it's a good example of what can be done with a low resolution screen.

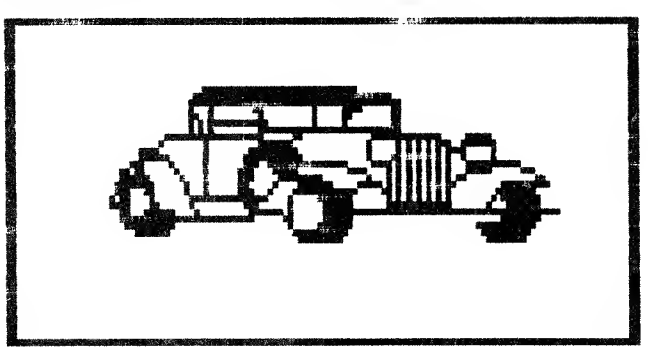


Figure 10.1 *Ford Roadster Program*

```
 1 REM  *** 1932 FORD ROADSTER ***
 2 REM  *** WRITTEN BY TOM DEMPSEY : APRIL 10,1980
 3 LPRINT CHR$ (31)"1932 FORD ROADSTER"
 5 CLEAR 1000
 6 REM  *** SET UP CHR$ ***
10 A$ = CHR$ (176) + STRING$ (15,188) + CHR$ (180) + STRING$
   (3,176)
20 B$ = CHR$ (170) + CHR$ (147) + CHR$ (171) + STRING$
   (4,131) + CHR$ (175) + STRING$ (5,131) + CHR$ (151) +
   STRING$ (2,131) + CHR$ (191) + CHR$ (143) + STRING$
   (3,131) + CHR$ (191)
30 C$ = STRING$ (2,176) + STRING$ (3,186) + STRING$ (4,
   179) + CHR$ (187) + CHR$ (141) + STRING$ (2,140) + CHR$
   (188) + CHR$ (140) + CHR$ (141) + STRING$ (2,140) +
   CHR$ (141) + STRING$ (2,140) + STRING$ (2,188) + CHR$
   (191) + STRING$ (4,176) + STRING$ (2,128)
40 D$ = CHR$ (160) + STRING$ (2,176)
50 E$ = CHR$ (168) + CHR$ (188) + CHR$ (182) + CHR$ (14
   4) + STRING$ (3,128) + CHR$ (149) + STRING$ (3,128) +
   CHR$ (184) + CHR$ (190) + STRING$ (3,191) + CHR$ (18
   0) + STRING$ (6,128) + CHR$ (170) + STRING$ (2,128) +
   CHR$ (186) + STRING$ (4,170) + CHR$ (171) + CHR$ (14
   0) + CHR$ (151)
60 F$ = STRING$ (2,131) + CHR$ (149)
70 G$ = CHR$ (168) + CHR$ (182) + CHR$ (191) + CHR$ (14
   4) + CHR$ (128) + CHR$ (130) + CHR$ (164) + STRING$
   (2,128) + CHR$ (149) + STRING$ (2,128) + CHR$ (168) +
   CHR$ (191) + CHR$ (129) + CHR$ (130) + CHR$ (175) +
   CHR$ (191) + CHR$ (183) + STRING$ (2,179) + STRING$
   (2,131)
80 H$ = CHR$ (137) + CHR$ (140) + CHR$ (164) + CHR$ (13
   1) + CHR$ (171) + STRING$ (6,170) + CHR$ (160) + CHR$
   (154) + STRING$ (2,143) + STRING$ (3,131) + CHR$ (14
   0) + CHR$ (164) + CHR$ (144)
90 I$ = CHR$ (160) + CHR$ (175) + CHR$ (151) + CHR$ (13
   1) + CHR$ (175) + STRING$ (3,128) + CHR$ (165) + CHR$
   (176) + CHR$ (181) + STRING$ (2,176) + CHR$ (186) +
   CHR$ (189) + CHR$ (176) + CHR$ (152) + CHR$ (129) +
   CHR$ (160) + CHR$ (142) + CHR$ (143) + CHR$ (175) +
   CHR$ (191) + STRING$ (2,188)
100 J$ = CHR$ (134) + STRING$ (2,131) + CHR$ (174) + STRING$
   (6,170) + CHR$ (129) + STRING$ (3,128) + CHR$ (152) +
   STRING$ (3,191) + CHR$ (183) + CHR$ (131)
110 K$ = CHR$ (130) + CHR$ (171) + CHR$ (181) + CHR$ (17
   6) + CHR$ (190) + CHR$ (189) + CHR$ (188) + CHR$ (17
   6) + CHR$ (178) + CHR$ (180) + STRING$ (4,176) + CHR$
   (187) + CHR$ (141) + STRING$ (2,140) + CHR$ (186) +
   STRING$ (3,128) + STRING$ (3,191) + STRING$ (3,140) +
   CHR$ (142)
120 L$ = STRING$ (6,143) + STRING$ (3,140) + CHR$ (142) +
```

```
    CHR$ (140) + CHR$ (190) + STRING$ (3,191) + STRING$
    (2,140)
130 M$ = CHR$ (131) + STRING$ (3,143) + CHR$ (135) + STRING$
    (11,128) + CHR$ (130) + CHR$ (172) + CHR$ (188) + CHR$
    (190) + STRING$ (2,191) + CHR$ (135) + STRING$ (12,1
    28) + CHR$ (130) + CHR$ (175) + STRING$ (3,191) + CHR$
    (159) + CHR$ (129)
140 CLS
145 REM  *** PRINT PICTURE ***
150 PRINT @211,A$;
160 PRINT @274,B$;
170 PRINT @336,C$;
180 PRINT @366,D$;
190 PRINT @397,E$;
200 PRINT @431,F$;
210 PRINT @459,G$;
220 PRINT @482,H$;
230 PRINT @522,I$;
240 PRINT @547,J$;
250 PRINT @586,K$;
260 PRINT @615,L$;
270 PRINT @652,M$;
275 REM  *** SUBROUTINE SCAN SCREEN AND LPRINT ***
280 CLEAR 1000:
    LPRINT CHR$ (29):
    LPRINT CHR$ (27); CHR$ (56)
290 FOR  Y = 0 TO 47
300      P$ = ""
310      FOR  X = 0 TO 127
320           IF   POINT (X,Y)
              THEN P$ = P$ + CHR$ (191):
              ELSE P$ = P$ + " "
330      NEXT X
340      LPRINT P$
350 NEXT Y
355 REM  *** ADJ. PRINT SIZE & PRINT LISTING ***
360 LPRINT CHR$ (30):
    LPRINT CHR$ (27); CHR$ (54):
    LPRINT CHR$ (27); CHR$ (66):
    LLIST
```

VIDEOHEX

This program is not actually a game, but it does give an example of the different types of things that can be done with graphics and your computer. What this program lacks in speed, it makes up for in grace.

What does it do? It converts graphics on the screen into data lines, — not your *usual* data lines, but graphic codes in hex.

To use the program, type RUN, press ENTER and sit back to watch. After the program converts the screen into hex data lines, it clears the screen and deletes line 1000. You may now run the program again to watch it read the hex codes and draw the graphics back on the screen.

This program is strictly for people who like hex numbers. As for any practical uses, I haven't found them yet, — it's just too slow.

Figure 10.2 *VIDEOHEX Program*

```
1000 CLS :
     CLEAR 1000:
    ' BY TOM DEMPSEY
1010 PRINT @0,"BASIC HEX FILE ZAP V1.0 <> PRESS (M) TO MO
     DIFY AND ENTER TO SAVE"; STRING$ (64,143);
1020 PRINT @896,"FILE, RELATIVE SECTOR, BYTE ";:
     INPUT F$,V$,K$
1025 B$ = V$:
     GOSUB 1300:
     V = B + 1:
     B$ = K$:
     GOSUB 1300:
     K = B + 1
1030 OPEN "R",1,F$
1040 FIELD 1,255ASS$
1050 CH$ = S$
1060 GET 1,V
1070 CH$ = S$:
     CLOSE
1075 REM  ==============================
               CONVERT DECIMAL NUMBERS TO HEX
               ==============================
1080 H$ = "0123456789ABCDEF":
     PRINT @960,"ONE MOMENT PLEASE ";
1090 S(1) = 4096:
     S(2) = 256:
     S(3) = 16:
     S(4) = 1:
     Z = K + 20:
     IF   Z > 255
     THEN Z = 255
1100 FOR  X = K TO Z:
          N = ASC ( MID$ (S$,X,1)):
          X$ = "":
          FOR  J = 3 TO 4:
               P = S(J)
1110           FOR  I = 1 TO 16:
                    IF   N - I * P < 0
                    THEN X$ = X$ + MID$ (H$,I,1):
                         N = N - (I - 1) * P:
                         NEXT J:
                    ELSE NEXT I
1120                M$ = M$ + X$ + " ":
                    PRINT ".";:
               NEXT X
1130           PRINT @960,M$;
1135           REM  ==============================
                         MOVE CURSOR MODE TO BEGIN EDIT
                         ==============================
1140           M = 16320
```

```
1150            P = PEEK (M):
                Q = PEEK (14400):
                IF   PEEK (14338) = 320$ = INKEY$ :
                     GOTO 1200 ..................................
1160            POKE M,143:
                FOR  T = 1 TO 10:
                NEXT :
                POKE M,P:
                FOR  T = 1 TO 10:
                NEXT
1170            IF   Q = 32
                THEN M = M - 3:
                ELSE IF   Q = 64
                     THEN M = M + 3
1180            IF   M < 16320
                THEN M = 16320:
                ELSE IF   M > 16381
                     THEN M = 16380
1190            GOTO 1150 ..................................
-------------------------------------------------------------------
1195            REM  ==============================
                          EDITING MODE INSERT NEW HEX #S
                          ==============================
1200            I$ = INKEY$ :
                P = PEEK (M)
1210            POKE M,128:
                FOR  T = 1 TO 10:
                NEXT :
                POKE M,P:
                FOR  T = 1 TO 10:
                NEXT
1220            IF   I$ = ""
                THEN 1200: .................................
                ELSE IF   I$ = CHR$ (13)
                     THEN OPEN "R",1,F$:
                          GOTO 1270 ........................
1230            IF   ASC (I$) < 48
                THEN 1200: .................................
                ELSE IF   ASC (I$) > 70
                     THEN 1200 ..............................
1240            IF   ASC (I$) > 57 AND ASC (I$) < 65
                THEN 1200 ..................................
1250            PRINT @M - 15360,I$;:
                M = M + 1:
                IF   PEEK (M) = 32M = M + 1
1260            GOTO 1200 ..................................
-------------------------------------------------------------------
1265            REM  ==============================
                          SCANS SCREEN & WRITES NEW FILE
                          ==============================
1270            FOR  X = 16320 TO 16380 STEP 3:
```

```
                    P1 = PEEK (X):
                    P2 = PEEK (X + 1):
                    B$ = CHR$ (P1) + CHR$ (P2):
                    GOSUB 1300:
                    C$ = C$ + CHR$ (B):
               NEXT X
1280           MID$ (CH$,K,Z) = C$:
               LSET S$ = CH$:
               PUT 1,V:
               CLOSE :
               PRINT :
               PRINT
1290           M$ = "":
               S$ = "":
               C$ = "":
               GOTO 1010 ....................................
-------------------------------------------------------------
1295           REM  ============================
                         CONVERT HEX TO DECIMAL NUMBERS
                         ============================
1300           J = 1
1310           FOR  I = 1 TO 2:
                    D(I) = 0:
                    D(I) = ASC ( MID$ (B$,J,1)) - 48
1320                IF   D(I) > 9
                    THEN D(I) = D(I) - 7
1330                J = J + 1:
               NEXT I:
               B = 4096 * D(1) + 256 * D(2) + 16 * D(3) +
               D(4):
               B = B / 256
1340           RETURN  ......................................
```

Program Explanation

Lines 1000 to 1600 are dummy data lines. I think it's time programmers started calling dummy data and dummy string$ by a better name. How about memory reserve lines? That is what they really do.

Lines 1710 to 1760 are the drawing subroutine. They are put here only for demonstration; you can place any drawing program here that you wish. In lines 1770 to 1940 we PEEK the screen locations, convert the decimal values into X$, then convert the string back into decimal to POKE into our memory reserve lines.

Lines 1610 to 1700 read the hex data lines and convert them back into decimal before POKEing them back into the screen positions.

11

Educational Games

MATH TEACHER is a fun game to try to outsmart. If you can make it to the last section, good luck. As you play, the questions get harder.

The overall program is several small programs which are all strung together. In operation, it adds two random numbers and then asks you for the correct answer, which it already knows.

This shows yet another way to make use of random numbers, — letting the random number generator create math problems for us instead of programming each problem into the listing. This technique can give you long-running programs from short listings.

```
HOW MUCH IS  23 + 24 =? 47
```

```
HOW MUCH IS  23 + 24 =? 47
### YOU ARE RIGHT 47
```

```
HOW MUCH IS  35 + 5 =? 39
WRONG ANSWER 35 + 5 = 40
```

Figure 11.1 *Math Teacher Program*

```
 1 CLS
 2 PRINT "MATH PROBLEMS"
 3 FOR  X = 1 TO 1000
 4 NEXT X
 9 LET C = 0
10 CLS
20 N = RND (50)
30 LET N = N
40 A = RND (50)
50 LET A = A
60 PRINT "HOW MUCH IS ";N;"+";A;"=";
70 INPUT B
80 IF   B = N + A
   THEN 100 ..................................................
90 PRINT "WRONG ANSWER";N;"+";A;"=";N + A
92 FOR  X = 1 TO 5000
93 NEXT X
94 GOTO 10
-------------------------------------------------------------------
100 PRINT "*** YOU ARE RIGHT";N + A
110 LET C = C + 1
120 FOR  X = 1 TO 1000
130 NEXT X
140 IF   C = 10
    THEN 200 ..................................................
150 GOTO 10
-------------------------------------------------------------------
200 PRINT "I THINK YOU'RE READY FOR SOME HARDER QUESTION
    S!"
210 FOR  X = 1 TO 3000
220 NEXT X
230 LET C = 0
240 CLS
250 N = RND (10)
260 LET N = N
270 A = RND (10)
280 LET A = A
290 PRINT "HOW MUCH DOES";N;"X";A;"=";
300 INPUT B
310 IF   B = N * A
    THEN 350 ..................................................
320 PRINT "NO YOU'RE WRONG";N;"X";A;"=";N * A
330 FOR  X = 1 TO 5000
340 NEXT X
345 GOTO 240
-------------------------------------------------------------------
350 PRINT "YOU ARE RIGHT";N * A
355 FOR  X = 1 TO 1000
356 NEXT X
360 LET C = C + 1
```

```
370 IF   C = 10
    THEN 400 ..................................................
380 GOTO 240
-----------------------------------------------------------------
400 PRINT "THINK YOU'RE SMART, TRY THESE"
410 FOR  X = 1 TO 3000
415 NEXT X
420 LET C = 0
430 CLS
440 N = RND (100)
450 LET N = N
460 A = RND (100)
470 LET A = A
480 PRINT "HOW MUCH IS";N;"X";A;"=";
490 INPUT B
500 IF   B = N * A
    THEN 550 ..................................................
510 PRINT "WRONG";N;"X";A;"=";N * A
520 FOR  X = 1 TO 5000
530 NEXT X
540 GOTO 420
-----------------------------------------------------------------
550 PRINT "YOU'RE RIGHT";N * A
560 LET C = C + 1
570 FOR  X = 1 TO 1000
580 NEXT X
590 IF   C = 10
    THEN 700 ..................................................
600 GOTO 430
-----------------------------------------------------------------
700 PRINT "YOU'RE DOING BETTER THAN I EXPECTED, TRY THES
    E!"
701 PRINT "PLEASE GET A PEN AND PAPER! WHEN READY, ENTER
     #1"
702 INPUT O
703 IF   O = 1
    THEN 740 ..................................................
710 FOR  X = 1 TO 1000
720 NEXT X
740 CLS
750 N = RND (100)
760 LET N = N
770 A = RND (100)
780 LET A = A
790 D = RND (10)
800 LET D = D
810 S = RND (10)
820 LET S = S
830 P = RND (100)
840 LET P = P
850 PRINT "ARE YOU READY FOR THIS! YOU HAVE 60 SECONDS T
```

```
    O ANSWER"
880 PRINT N;"X";A;"/";D;"-";S;"+";P;"=";
910 FOR  X = 1 TO 30000
920 NEXT X
945 PRINT "THE ANSWER IS";N * A / D - S + P
950 FOR  X = 1 TO 1000
951 NEXT X
952 GOTO 740
```

MORSE CODE

MORSE CODE is great for learning the morse code. After typing RUN <ENTER>, the screen goes blank, and each time you type a letter, it is displayed on the screen in morse code. Send a secret message to your friends.

SUGGESTED CHANGES

Why not add sound so you can hear the code as you type it? A dot can be OUT255,0:OUT255,2 and a dash can be FORX = 1TO2:OUT255,0:OUT255,2: NEXTX.

In operation, this program makes use of the complete keyboard for control keys, and the graphics are created with the PRINT command.

If you press the letter (E), the computer prints a dot, which represents the morse code symbol for the letter E. We could just as easily have the computer print any letter or symbol we want when the typist hits different letters.

Figure 11.2 *Morse Code Program*

```
 10 CLS
 20 PRINT "THIS PROGRAM TURNS YOUR KEYBOARD INTO A"
 30 PRINT "MORSE CODE PRINTER...WHEN THE SCREEN IS CLEAR
    "
 40 PRINT "IT'S READY TO USE. JUST START TYPING."
 50 PRINT :
    PRINT "WHEN READY HIT ENTER....."
 60 INPUT B$
 70 CLS
 80 PRINT CHR$ (23)
 90 A$ = INKEY$ :
    IF   A$ = "A" PRINT ".-";
100 IF   A$ = "B" PRINT "-...";
110 IF   A$ = "C" PRINT "-.-.";
120 IF   A$ = "D" PRINT "-..";
130 IF   A$ = "E" PRINT ".";
140 IF   A$ = "F" PRINT "..-.";
150 IF   A$ = "G" PRINT "--.";
160 IF   A$ = "H" PRINT "....";
170 IF   A$ = "I" PRINT "..";
180 IF   A$ = "J" PRINT ".---";
190 IF   A$ = "K" PRINT "-.-";
200 IF   A$ = "L" PRINT ".-..";
210 IF   A$ = "M" PRINT "--";
220 IF   A$ = "N" PRINT "-.";
230 IF   A$ = "O" PRINT "---";
240 IF   A$ = "P" PRINT ".--.";
250 IF   A$ = "Q" PRINT "--.-";
260 IF   A$ = "R" PRINT ".-.";
270 IF   A$ = "S" PRINT "...";
280 IF   A$ = "T" PRINT "-";
290 IF   A$ = "U" PRINT "..-";
300 IF   A$ = "V" PRINT "...-";
310 IF   A$ = "W" PRINT ".--";
320 IF   A$ = "X" PRINT "-..-";
330 IF   A$ = "Y" PRINT "-.--";
340 IF   A$ = "Z" PRINT "--..";
350 IF   A$ = " " PRINT " ";
360 GOTO 90
```

SILVER WEIGHT CONTENT

This one is for all the coin collectors out there! The program does all the work for you. It tells you how much silver is in your coins and what their dollar value is at the current market price!

The following explains the program operation.

Line 20 gets the present silver value.
Lines 30 to 180 multiply the number of coins by silver content.
Lines 190 to 310 print out the totals.

Figure 11.3 *Silver Program*

```
10 CLS
20 INPUT "ENTER PRESENT VALUE OF SILVER FOR 1 OZ.";I:
   CLS
30 PRINT "HOW MANY SILVER DOLLARS"
40 INPUT S
50 LET S = S * .77
```

```
 60 PRINT "HOW MANY HALF DOLLARS"
 70 INPUT H
 80 LET H = H * .385
 90 PRINT "HOW MANY QUARTERS"
100 INPUT Q
110 LET Q = Q * .1925
120 PRINT "HOW MANY DIMES"
130 INPUT D
140 LET D = D * .077
150 PRINT "HOW MANY 1942-1945 NICKELS"
160 INPUT N
170 LET N = N * .0385
180 CLS
190 PRINT "SILVER WEIGHT CONTENT"
200 PRINT
210 PRINT "DOLLARS=";S;" OZ."
220 PRINT "HALF DOLLARS=";H;" OZ."
230 PRINT "QUARTERS=";Q;" OZ."
240 PRINT "DIMES=";D;" OZ."
250 PRINT "NICKELS=";N;" OZ."
260 PRINT :
    PRINT "TOTAL WEIGHT IN SILVER=";S + H + Q + D + N;"
    OZ."
270 PRINT "TO CONTINUE HIT ENTER"
280 INPUT A$
290 PRINT "TOTAL DOLLAR VALUE IN SILVER IS...$";(S + H +
    Q + D + N) * I
300 PRINT
310 END
```

MEMORY MAGIC

MEMORY MAGIC is a memory game for 1 or more players. The game starts by showing you a 6 by 8 grid and filling up random squares on the grid. This game has 3 levels of play, so it's good for all ages. The game is a very good method of increasing your memory retention and becomes very competitive between two or more players.

After a few seconds delay, the filled in squares are cleared, and the object is to replace them in the correct order. After you have entered the total number that you think were originally on the screen, the computer shows you where the original squares were and prints out the percentage of correct answers you had in the game.

The first time my wife sat down and tried this game, she selected the expert mode. Then she played and got 100% correct on the first try. I didn't have the courage to tell her that I was still trying to get past the beginner mode. It's very embarrassing for a programmer to lose at a game he wrote himself!

The following is an explanation of MEMORY MAGIC.

Lines 10 to 15 clear screen, print title.
Lines 20 to 250 set up the playing board.
Lines 260 to 460 get players' input.
Lines 465 to 490 check for match.
Lines 500 to 530 keep scores.
Lines 600 to 680 show original board; ask to play again.

Figure 11.4 *Memory Magic Program*

```
10 CLS :
   DIM B(48)
15 PRINT CHR$ (23):
   PRINT @448,"MEMORY MAGIC BY TOM DEMPSEY":
   FOR  X = 1 TO 1000:
   NEXT :
   CLS
16 PRINT "ENTER LEVEL OF PLAY":
   PRINT :
   PRINT "1 = BEGINNER":
   PRINT "2 = ADVANCED":
   PRINT "3 = EXPERT"
17 INPUT S:
   IF   S = 1S = 5:
   ELSE IF   S = 2S = 4:
        ELSE IF   S = 3S = 2
18 CLS
20 FOR  A = 2 TO 38 STEP 6
30      FOR  M = 0 TO 113:
             SET (M,A):
        NEXT
40 NEXT A
50 FOR  A = 0 TO 113 STEP 14
60      FOR  M = 2 TO 38:
             SET (A,M):
             SET (A + 1,M):
        NEXT
70 NEXT A
75 B = 1
80 FOR  A = 121 TO 824 STEP 128
90      PRINT @A,B;:
        B = B + 1:
   NEXT A
100 X = 65
110 FOR  A = 835 TO 885 STEP 7
120      POKE 15360 + A,X:
         X = X + 1:
   NEXT A
130 DATA 65,72,79,86,93,100,107,114
140 DATA 193,200,207,214,221,228,235,242
150 DATA 321,328,335,342,349,356,363,370
160 DATA 449,456,463,470,477,484,491,498
170 DATA 577,584,591,598,605,612,619,626
180 DATA 705,712,719,726,733,740,747,754
190 A$ = STRING$ (6,191):
    B$ = STRING$ (6,128):
    C$ = STRING$ (6,176)
200 FOR  X = 1 TO 48:
         R = RND (S)
210      READ D:
```

```
          IF   R = 1 PRINT @D,A$;:
               PRINT @D + 64,A$;
220       IF   R = 1B(N) = D:
               N = N + 1
230 NEXT X
240 FOR  X = 1 TO 10000:
    NEXT
250 RESTORE
260 FOR  X = 1 TO 48:
          READ D:
          PRINT @D,B$;:
          PRINT @D + 64,C$;:
    NEXT
270 PRINT @896,"                              ";:
    PRINT @896,"NUMBER  ";
280 I$ = INKEY$ :
    IF   I$ = ""
    THEN 280 ..................................................
281 IF   PEEK (14400) = 2 AND K = 0 PRINT @T,B$;:
          PRINT @T + 64,C$;:
          TT = TT - 1:
          K = 1:
          QQ = QQ - 1:
          GOTO 270 ..............................................
285 IF   I$ < CHR$ (49) OR I$ > CHR$ (54)
    THEN 270 ..................................................
290 IF   I$ = "1"T = 65
300 IF   I$ = "2"T = 193
310 IF   I$ = "3"T = 321
320 IF   I$ = "4"T = 449
330 IF   I$ = "5"T = 577
340 IF   I$ = "6"T = 705
350 PRINT I$;
360 PRINT @910,"          ";:
    PRINT @910,"LETTER  ";
370 I$ = INKEY$ :
    IF   I$ = ""
    THEN 370 ..................................................
375 IF   I$ < CHR$ (65) OR I$ > CHR$ (72)
    THEN 360 ..................................................
380 IF   I$ = "A"T = T
390 IF   I$ = "B"T = T + 7
400 IF   I$ = "C"T = T + 14
410 IF   I$ = "D"T = T + 21
420 IF   I$ = "E"T = T + 28
430 IF   I$ = "F"T = T + 35
440 IF   I$ = "G"T = T + 42
450 IF   I$ = "H"T = T + 49
460 PRINT I$;
470 TT = TT + 1
480 FOR  Q = 0 TO N - 1
```

```
490       IF   T = B(Q)
          THEN QQ = QQ + 1
495 NEXT Q
500 PRINT @T,A$;:
    PRINT @T + 64,A$;:
    Q = 0:
    K = 0:
    IF   TT = N
    THEN 600: ..................................................
    ELSE 270 ...................................................
-------------------------------------------------------------------
600 REM  *** SEE BOARD ***
610 PRINT @896,"HIT ENTER TO COMPARE BOARD";
620 L$ = INKEY$ :
    IF   L$ < > CHR$ (13)
    THEN 620 ...................................................
630 FOR  P = 0 TO N - 1:
         PRINT @B(P),"*";:
    NEXT
640 PRINT @896,QQ;"OUT OF ";N;"CORRECT OR ";:
    PRINT USING "##.##";QQ / N;:
    PRINT "%  PLAY AGAIN (Y/N)";
650 I$ = INKEY$ :
    IF   I$ = ""
    THEN 650 ...................................................
660 IF   I$ = "N"
    THEN CLS :
         END  ..................................................
670 IF   I$ = "Y" RUN  .....................................
680 GOTO 650
-------------------------------------------------------------------
```

NOTES

12

Puzzle Games

TREASURE HUNT is played on a 9 by 5 grid. The idea is to find the gold by digging holes. Each time you play the game the treasure is hidden in a different location. It's harder than it looks. The best score I know of so far is 7 trys! Can you think of the fastest way to find the treasure?

In TREASURE HUNT we use our random number to hide the treasure on the grid. This type of game is good for display on the screen. You might want to let two players play at the same time, and the first to find the gold wins.

The following lines contain an explanation of TREASURE HUNT.

Lines 10 to 70 print the rules.
Lines 90 to 540 convert RND to grid locations.
Lines 550 to 730 set up grid lines.
Lines 740 to 1190 convert player's input to grid locations.
Lines 1200 to 1270 dig the holes and check for wins.

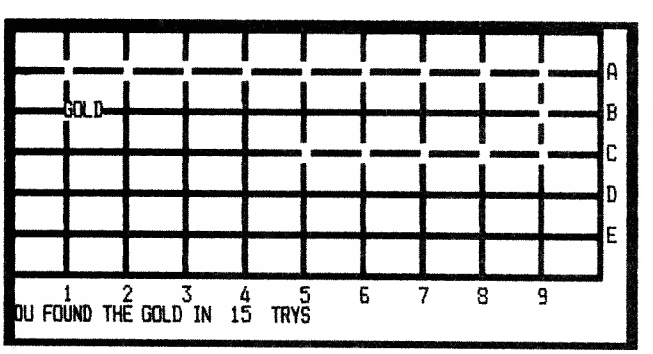


Figure 12.1 *Treasure Hunt Program*

```
 10 CLS :
    PRINT "THIS GAME IS CALLED TREASURE HUNT"
 20 PRINT "THE OBJECT IS TO FIND THE GOLD..ENTER THE POS
    ITIONS"
 30 PRINT "YOU HAVE TO DIG YOUR HOLE LIKE THIS (C6). SEE
     HOW"
 40 PRINT "MANY HOLES YOU HAVE TO DIG TO FIND THE GOLD."
 50 PRINT "YOU CANNOT MOVE MORE THAN 1 POSITION IN ANY "
 60 PRINT "DIRECTION IN A TURN...."
 70 PRINT :
    PRINT "TO PLAY HIT ENTER";:
    INPUT A$
 80 CLS
 90 A = 1:
    S = 0
100 T = RND (44)
110 IF    T = 1 LET T = 134
120 IF    T = 2 LET T = 140
130 IF    T = 3 LET T = 146
140 IF    T = 4 LET T = 152
150 IF    T = 5 LET T = 158
160 IF    T = 6 LET T = 164
170 IF    T = 7 LET T = 170
180 IF    T = 8 LET T = 176
190 IF    T = 9 LET T = 182
200 IF    T = 10 LET T = 262
210 IF    T = 11 LET T = 268
220 IF    T = 12 LET T = 274
230 IF    T = 13 LET T = 280
240 IF    T = 14 LET T = 286
250 IF    T = 15 LET T = 292
260 IF    T = 16 LET T = 298
270 IF    T = 17 LET T = 304
280 IF    T = 18 LET T = 310
290 IF    T = 19 LET T = 390
300 IF    T = 20 LET T = 396
310 IF    T = 21 LET T = 402
320 IF    T = 22 LET T = 408
330 IF    T = 23 LET T = 420
340 IF    T = 24 LET T = 426
350 IF    T = 25 LET T = 432
360 IF    T = 26 LET T = 438
370 IF    T = 27 LET T = 518
380 IF    T = 28 LET T = 524
390 IF    T = 29 LET T = 530
400 IF    T = 30 LET T = 536
410 IF    T = 31 LET T = 542
420 IF    T = 32 LET T = 548
430 IF    T = 33 LET T = 554
440 IF    T = 34 LET T = 560
450 IF    T = 35 LET T = 566
460 IF    T = 36 LET T = 646
470 IF    T = 37 LET T = 652
480 IF    T = 38 LET T = 658
490 IF    T = 39 LET T = 664
500 IF    T = 40 LET T = 670
510 IF    T = 41 LET T = 676
520 IF    T = 42 LET T = 682
530 IF    T = 43 LET T = 688
540 IF    T = 44 LET T = 694
550 FOR   M = 0 TO 120:
          SET (M,A):
    NEXT
560 IF    A = 37
    THEN 580 ..................................................
570 A = A + 6:
    GOTO 550
```

```
  580 A = 0
  590 FOR  M = 1 TO 37:
           SET (A,M):
      NEXT
  600 A = A + 12
  610 IF   A > 120
      THEN 630 ..................................................
  620 GOTO 590
-------------------------------------------------------------------
  630 A = 1:
      B = 837
  640 PRINT @B,A;
  650 A = A + 1:
      B = B + 6
  660 IF   B > 886
      THEN 680 ..................................................
  670 GOTO 640
-------------------------------------------------------------------
  680 PRINT @189,"A";
  690 PRINT @317,"B";
  700 PRINT @445,"C";
  710 PRINT @573,"D";
  720 PRINT @701,"E";
  730 B = 414:
      PRINT @B," ";
  740 PRINT @896,"MOVE          ";:
      INPUT A$
  750 IF   A$ = "A1" LET A = 134
  760 IF   A$ = "A2" LET A = 140
  770 IF   A$ = "A3" LET A = 146
  780 IF   A$ = "A4" LET A = 152
  790 IF   A$ = "A5" LET A = 158
  800 IF   A$ = "A6" LET A = 164
  810 IF   A$ = "A7" LET A = 170
  820 IF   A$ = "A8" LET A = 176
  830 IF   A$ = "A9" LET A = 182
  840 IF   A$ = "B1" LET A = 262
  850 IF   A$ = "B2" LET A = 268
  860 IF   A$ = "B3" LET A = 274
  870 IF   A$ = "B4" LET A = 280
  880 IF   A$ = "B5" LET A = 286
  890 IF   A$ = "B6" LET A = 292
  900 IF   A$ = "B7" LET A = 298
  910 IF   A$ = "B8" LET A = 304
  920 IF   A$ = "B9" LET A = 310
  930 IF   A$ = "C1" LET A = 390
  940 IF   A$ = "C2" LET A = 396
  950 IF   A$ = "C3" LET A = 402
  960 IF   A$ = "C4" LET A = 408
  970 IF   A$ = "C5" LET A = 414
  980 IF   A$ = "C6" LET A = 420
  990 IF   A$ = "C7" LET A = 426
 1000 IF   A$ = "C8" LET A = 432
 1010 IF   A$ = "C9" LET A = 438
 1020 IF   A$ = "D1" LET A = 518
 1030 IF   A$ = "D2" LET A = 524
 1040 IF   A$ = "D3" LET A = 530
 1050 IF   A$ = "D4" LET A = 536
 1060 IF   A$ = "D5" LET A = 542
 1070 IF   A$ = "D6" LET A = 548
 1080 IF   A$ = "D7" LET A = 554
 1090 IF   A$ = "D8" LET A = 560
 1100 IF   A$ = "D9" LET A = 566
 1110 IF   A$ = "E1" LET A = 646
 1120 IF   A$ = "E2" LET A = 652
 1130 IF   A$ = "E3" LET A = 658
 1140 IF   A$ = "E4" LET A = 664
 1150 IF   A$ = "E5" LET A = 670
 1160 IF   A$ = "E6" LET A = 676
 1170 IF   A$ = "E7" LET A = 682
 1180 IF   A$ = "E8" LET A = 688
 1190 IF   A$ = "E9" LET A = 694
 1200 IF   B - A = 6 OR A - B = 6
```

```
      THEN 1230
1210  IF   B - A = 128 OR A - B = 128
      THEN 1230
1220  PRINT @896,"INVALID MOVE":
      FOR  X = 1 TO 500:
      NEXT :
      GOTO 740
```

```
1230  PRINT @A," ";
1240  LET B = A
1250  S = S + 1
1260  IF   T = B PRINT @T,"GOLD";:
           PRINT @896,"YOU FOUND THE GOLD IN ";S;" TRYS":
           GOTO 1260
1270  GOTO 740
```

LAST STRAW

LAST STRAW is a popular numbers game, but this one uses graphics. The game starts by asking how many straws you would like to start with and the maximum number a player can remove in a turn. It then draws the straws and begins the game.

There is a number combination you can play to beat the computer every time, but I'm not going to tell!

The following is an explanation of LAST STRAW.

Lines 10 to 180 are for player input and rules.
Lines 190 to 230 draw the straws.
Lines 240 to 560 keep the score.
Lines 570 to 680 remove the straws.

Figure 12.2 *Last Straw Program*

```
 10 REM  *** LAST STRAW
 20 REM  *** WRITTEN BY TOM DEMPSEY
 30 CLS
 40 LET A = 0:
    LET B = 0
 50 PRINT "THIS GAME IS CALLED LAST STRAW LOSES"
 60 PRINT "HOW MANY STRAWS DO YOU WANT TO START WITH (2-
    26).";
 70 INPUT N
 80 IF   N > 26
    THEN 60 ..................................................
 90 IF   N < 2
    THEN 60 ..................................................
100 PRINT "MAXIMUM NUMBER OF STRAWS WE CAN REMOVE";
110 INPUT K
120 PRINT
130 PRINT "INSTRUCTIONS FOR PLAYING LAST STRAW"
140 PRINT "THE NUMBER OF STRAWS IN THE PILE IS";N
150 PRINT "WE CAN REMOVE FROM 1 TO ";K;"STRAWS IN A TURN
    "
160 PRINT "THE PLAYER TO REMOVE THE LAST STRAW LOSES."
170 INPUT "WHEN YOU'RE READY TO PLAY, HIT ENTER";A$
180 CLS
190 FOR  M = 30 TO 47:
         SET (A,M):
    NEXT M
200 LET A = A + 5
210 LET B = B + 1
220 IF   B = N LET A = 0:
         GOTO 240 ............................................
230 GOTO 190
-------------------------------------------------------------
240 PRINT @0,"YOUR MOVE";
250 INPUT X
260 IF   X > K
    THEN 290 ................................................
270 IF   X < 1
    THEN 290 ................................................
280 GOTO 570
-------------------------------------------------------------
290 PRINT @0,"ILLEGAL MOVE"
300 PRINT
310 GOTO 240
-------------------------------------------------------------
320 LET N = N - X
330 IF   N > 0
    THEN 370 ................................................
340 IF   N = 0
    THEN 350 ................................................
350 PRINT "***** COMPUTER WINS *****"
360 IF   N = 0
    THEN 560 ................................................
370 PRINT
380 LET Q = INT ((N - 1) / (K + 1))
390 LET Y = N - 1 - Q * (K + 1)
400 IF   Y = 0
    THEN 490 ................................................
410 LET N = N - Y
420 PRINT "COMPUTER TAKES";Y
430 GOTO 630
-------------------------------------------------------------
440 IF   N = 0
    THEN 550 ................................................
450 PRINT "STRAWS LEFT IN PILE-";N
460 PRINT
470 PRINT
480 GOTO 240
-------------------------------------------------------------
```

Figure 13.1 *Invasion Program*

```
 10 B = 120:
    C = 192:
    D = 320:
    E = 500
 30 CLS :
    INPUT "ENTER NAME,HIGH SCORE OF LAST GAME";W$,O
 40 GOTO 450
-------------------------------------------------------------------------
 50 TIME = 250
 60 INPUT "ENTER YOUR NAME";N$
 70 CLS
 80 S$ = CHR$ (191)
 90 A$ = CHR$ (140) + STRING$ (3,143) + CHR$ (140)
100 B$ = CHR$ (176) + STRING$ (3,143) + CHR$ (176)
110 C$ = "<***>"
120 D$ = CHR$ (140) + STRING$ (3,191) + CHR$ (140)
130 P$ = " USING "
140 P = 960
150 PRINT @P,P$;
160 L = P
170 IF   PEEK (14400) = 32
    THEN P = P - 4
180 IF   PEEK (14400) = 64
    THEN P = P + 4
190 IF   PEEK (14400) = 8 GOSUB 330
200 IF   P < 960P = 960
210 IF   P > 1022P = 1022
220 TIME = TIME - 1:
    PRINT @50,"TIME LEFT";TIME:
    IF   TIME = 0 PRINT @470,"E N D  O F  G A M E":
         FOR  X = 1 TO 1000:
              NEXT :
              GOTO 450 ..........................................
230       PRINT @L," ";:
          PRINT @P,P$;
240       PRINT @B,A$;"  "
250       B = B - 2:
          IF   B = 64 PRINT @B,"       ":
               B = 120
260       PRINT @C,"  ";B$;
270       C = C + 1:
          IF   C = 250 PRINT @C,"        ":
               C = 192
280       PRINT @D,"    ";C$;
290       D = D + 4:
          IF   D > 378 PRINT @D,"        ":
               D = 320
300       PRINT @E,D$;"  "
310       E = E - 2:
          IF   E = 448 PRINT @E,"        ":
               E = 500
320       GOTO 160 ..........................................
-------------------------------------------------------------------------
330       A = P - 128
340       PRINT @A,S$;:
          OUT 255,0:
          OUT 255,2:
          PRINT @A," ";
350       IF   A = B + 2 OR A = C + 2 OR A = D OR A = E +
               2 GOSUB 380
360       A = A - 128:
          IF   A < 64 RETURN  ...............................
370       GOTO 340 ..........................................
```

13

Arcade Games

SAUCER INVASION

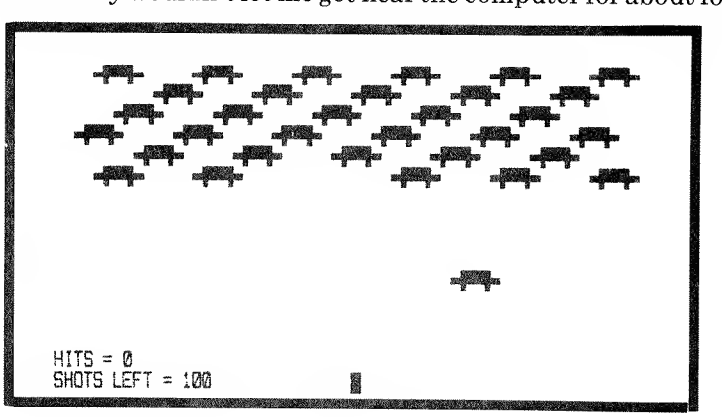
I started writing this game at about five o'clock one morning. I was wondering what a graphics game book would be like without a real-time, arcade-type game in BASIC. A real-time game in BASIC? Did you know that the PRINT statement is faster than the POKE statement for certain conditions?

The game starts by asking for the high score and the player's name. If this is your first time playing, just enter (A,0). The program keeps track of the name and score of the best player after each game.

When you're ready to play, just enter your name. If you beat the last high score, you get your name in lights.

To move your gun, use the left and right arrows, and use the up arrow to fire. I always let my kids test my games because their reflexes are faster than an adult's. They think that most games which seem fast to me are too slow.

They gave me their approval on this game after playing it only once. The only problem was that they wouldn't let me get near the computer for about four hours.



```
490 IF   N > 1
    THEN 520 ..................................................
500 LET Y = 1
510 GOTO 410
-------------------------------------------------------------------
520 LET Y = 1 + INT (K * RND (1))
530 IF   Y > K
    THEN 500 ..................................................
540 GOTO 410
-------------------------------------------------------------------
550 PRINT "***** YOU WIN *****"
560 END
-------------------------------------------------------------------
570 LET B = 0:
    LET A = A
580 FOR  M = 30 TO 47:
         RESET (A,M):
    NEXT M
590 LET A = A + 5
600 LET B = B + 1
610 IF   B = X GOTO 320 ...................................
620 GOTO 580
-------------------------------------------------------------------
630 LET B = 0:
    LET A = A
640 FOR  M = 30 TO 47:
         RESET (A,M):
    NEXT M
650 LET A = A + 5
660 LET B = B + 1
670 IF   B = Y GOTO 440 ...................................
680 GOTO 640
-------------------------------------------------------------------
```

```
380       IF    A = B + 2 FOR  X = 1 TO 10:
                  PRINT @B,"P O W":
                  PRINT @B,"     ":
                  NEXT
390             IF    A = C + 2 FOR  X = 1 TO 10:
                        PRINT @C,"P O W":
                        PRINT @C,"     ":
                        NEXT
400                   IF    A = D FOR  X = 1 TO 10:
                              PRINT @D,"P O W":
                              PRINT @D,"     ":
                              NEXT :
                              T = T + 90
410                           IF    A = E + 2 FOR  X = 1 TO 10:

                                    PRINT @E,"P O W":
                                    PRINT @E,"     ":
                                    NEXT
420                           T = T + 10:
                              PRINT @0,"POINTS =";T
430                           FOR  X = 1 TO 10:
                                    OUT 255,0:
                                    OUT 255,2:
                              NEXT
440                           RETURN  .........................
-------------------------------------------------------------------
450                           CLS :
                              PRINT CHR$ (23)
460                           IF    T > O
                              THEN O = T:
                                    W$ = N$
470                           PRINT @448,"HIGH SCORE"
480                           PRINT :
                              PRINT W$;" WITH ";O;" POINT
                              S"
490                           FOR  X = 1 TO 2000:
                              NEXT
500                           T = 0
510                           GOTO 50 .........................
-------------------------------------------------------------------
```

Explanation of SAUCER INVASIONS

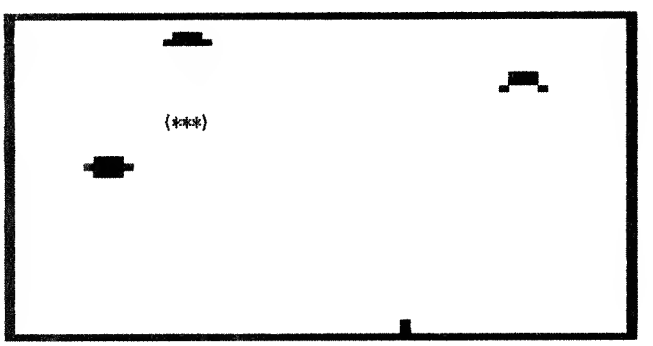
Line 10 sets up the starting values for the saucers.
Line 20 disables the break key in case a player wants to change his score.
Line 30 gets high score for score to beat.
Line 40 GOTO score keeper and print score.
Line 50 is the timer.
Line 60 inputs next player's name.
Lines 80 to 130 set up graphics characters.
Lines 140 to 210 print controls.
Line 190 checks if shot is fired.
Line 220 checks for end of game.
Lines 230 to 320 advance and print saucers.
Lines 330 to 340 print shot and sound effects.
Line 350 checks for hit.
Line 360 checks if shot is done.
Lines 380 to 410 show hits on screen.
Line 420 adds score.
Line 430 is sound for hits.
Lines 450 to 510 are score keeper.

SAUCER WARS

The SAUCER WARS game started out as an experiment for moving shapes in different directions around the screen without getting lost in a maze of code. It ended up becoming a game for my kids. A lot of my games start this way. My kids see them and say, "Gee, that would make a neat game, Dad." Well, you know the rest of the story.

In this game you control your own flying saucer. You move your ship with the arrow keys and fire at the enemy by pressing the space bar. The enemy cannot shoot back at you, but if they hit your ship, the game ends. It's not as easy as it sounds because they're coming at you from all sides!

The listing for this game contains the complete program explanation. The variations of this type game are endless. Just keep in mind that when using BASIC it's best to keep your code as short as possible. This does not mean short programs, but short loops. Don't try to make too many things happen at a time when working with BASIC.



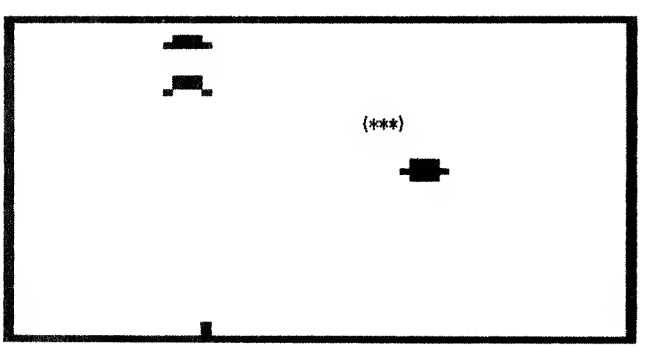


Figure 13.2 *Saucer Wars Program*

```
 10 CLS :
    IF   PEEK (16396) < > 201
    THEN PRINT "NOT FOR DISK SYSTEM":
         END ..................................................
 20 DEFINT A - Z:
    CLEAR 100
 30 AD = 32739:
    HI = INT (AD / 256):
    POKE 16527,HI:
    POKE 16526,AD - HI * 256
 40 FOR  I = AD TO AD + 28:
         READ DT:
         POKE I,DT:
    NEXT
 50 DATA 205,127,10,62,1,14,0,237,91,61,64,69,47,230,3,1
    79,211,255,13,40,4,16,246,24,242,37,32,241,201
 60 CLS
 70 PRINT CHR$ (23)
 80 PRINT @456,"S A U C E R   W A R S"
 90 FOR  X = 1 TO 1500:
    NEXT
100 PRINT @448,"FUN GAMES WRITTEN BY TOM DEMPSEY"
110 FOR  X = 1 TO 2000:
    NEXT :
    CLS
120 PRINT CHR$ (23):
    PRINT @448,"DO YOU NEED INSTRUCTIONS (Y/N)";
130 INPUT I$:
    IF   I$ = "N"
    THEN 190 .............................................
140 CLS :
    PRINT CHR$ (23):
    PRINT "TO MOVE YOUR SHIP USE THE ARROW KEYS"
150 PRINT "USE THE SPACE BAR TO FIRE LASER"
160 PRINT "IF THE ENEMY CRASHES INTO YOUR  SHIP THE GAME
     ENDS!"
170 PRINT :
    PRINT "DONT FORGET TO USE SOUND IF YOU HAVE IT"
180 PRINT :
    INPUT "TO CONTINUE HIT ENTER";I$
190 CLS
200 H = RND (1000)
210 T = RND (1000)
220 S = 476
230 REM ****************** CREATE PLAYERS SHIP
240 A$ = CHR$ (176) + CHR$ (188) + CHR$ (188) + CHR$ (18
    8) + CHR$ (176)
250 PRINT @L,"          ";
260 IF   S < 1 OR S > 954 LET S = L
270 L = S
280 PRINT @S,A$;
290 REM ****************** CHECK IF PLAYER MOVES SHIP
300 B$ = INKEY$
310 IF   PEEK (14400) = 8
    THEN S = S - 64:
         GOTO 250 ........................................
320 IF   PEEK (14400) = 16
    THEN S = S + 64:
         GOTO 250 ........................................
330 IF   PEEK (14400) = 32
    THEN S = S - 2:
         GOTO 250 ........................................
340 IF   PEEK (14400) = 64
    THEN S = S + 2:
         GOTO 250 ........................................
350 REM ****************** RELOCATE ENEMY
360 IF   H < 10H = RND (1000)
370 IF   T < 10T = RND (1000)
```

```
380 REM ***************** FIRE LASER
390 IF   B$ = " " PRINT @S + 5,"........................
          ......";
400 PRINT @H,V$;
410 PRINT @T,V$;
420 REM ***************** CREATE LASER SOUND
430 IF   B$ = " " FOR  N = 1 TO 4:
               SS = USR (5115):
               NEXT N
440       REM *************** CREATE SOUND OF ENEMY SHIP
450       OUT 255,0:
          OUT 255,2
460       REM *************** REMOVE LASER FIRE
470       IF   B$ = " " PRINT @S + 5,"
                        ";
480       K = S:
          W = S + 30:
          U = S + 30
490       REM ***************** CHECK FOR LASER HIT
500       IF   B$ = " " AND H > K AND H < W GOTO 910 ..........
510       IF   B$ = " " AND T > K AND T < U GOTO 1080 .........
520       REM *************** CREATE ENEMY SHIP
530       V$ = CHR$ (176) + CHR$ (188) + CHR$ (188) + CHR$
          (188) + CHR$ (176)
540       PRINT @H,V$;
550       PRINT @H,"      ";
560       PRINT @T,"      ";
570       REM ***************** CHECK FOR PLAYERS SHIP DE
          STROYED
580       IF   S = H OR S = T GOTO 800 ........................
590       IF   S = H GOTO 800 .................................
600       IF   S = H + 1 GOTO 800 .............................
610       IF   S = H - 1 GOTO 800 .............................
620       IF   S = H + 2 GOTO 800 .............................
630       IF   S = H - 2 GOTO 800 .............................
640       IF   S = H + 3 GOTO 800 .............................
650       IF   S = H - 3 GOTO 800 .............................
660       IF   S = T GOTO 1020 ................................
670       IF   S = T - 1 GOTO 1020 ............................
680       IF   S = T + 1 GOTO 1020 ............................
690       IF   S = T - 2 GOTO 1020 ............................
700       IF   S = T + 2 GOTO 1020 ............................
710       IF   S = T - 3 GOTO 1020 ............................
720       IF   S = T + 3 GOTO 1020 ............................
730       IF   H < 10H = RND (1000)
740       IF   T < 10T = RND (1000)
750       REM ***************** ADVANCE ENEMY SHIPS
760       H = H - 6
770       T = T - 65
780       GOTO 300 ............................................
-------------------------------------------------------------
790       REM ***************** DESTROY PLAYERS SHIP
800       PRINT @S, CHR$ (176) + " " + CHR$ (188) + " " +
          CHR$ (176)
810       FOR  J = 0 TO 60 STEP 5:
               FOR  I = 277 TO 267 STEP - 1:
                    SS = USR (I + J):
               NEXT I:
          NEXT J
820       FOR  X = 1 TO 100:
          NEXT
830       CLS
840       PRINT @S, CHR$ (176) + "   " + CHR$ (188) + "
           " + CHR$ (176)
850       FOR  N = 1 TO 10:
               SS = USR (5454):
          NEXT N
860       FOR  X = 1 TO 100:
          NEXT
870       CLS
880       PRINT @0,"ENEMY SHIPS DESTROYED = ";P
890       INPUT "TO PLAY AGAIN HIT ENTER";I$:
          GOTO 190 ............................................
```

```
 900       REM ***************** DESTROY ENEMY SHIP
 910       PRINT @H,"      "
 920       P = P + 1:
           IF   P = 20 PRINT @448,"MAY THE FORCE BE WITH Y
           OU : YOU KILLED 20 ALIENS":
           END
 930       PRINT @H, CHR$ (183) + " " + CHR$ (155) + " " +
           CHR$ (166) + " " + CHR$ (191)
 940       FOR  J = 0 TO 60 STEP 5:
                FOR  I = 377 TO 367 STEP - 1:
                     SS = USR (I + J):
                NEXT I:
           NEXT J
 950       FOR  X = 1 TO 100:
           NEXT
 960       PRINT @H,"       "
 970       PRINT @H, CHR$ (183) + "      " + CHR$ (191)
 980       FOR  X = 1 TO 100:
           NEXT
 990       PRINT @H,"       "
1000       H = RND (1000)
1010       CLS :
           GOTO 250 ..........................................
-----------------------------------------------------------
1020       REM ***************** DESTROY PLAYERS SHIP
1030       PRINT @S,"      "
1040       FOR  J = 0 TO 60 STEP 5:
                FOR  I = 277 TO 267 STEP - 1:
                     SS = USR (I + J):
                NEXT I:
           NEXT J
1050       FOR  N = 1 TO 10:
                SS = USR (5454):
           NEXT N
1060       PRINT @0,"ENEMY SHIPS DESTROYED = ";P
1070       INPUT "TO PLAY AGAIN HIT ENTER";I$:
           GOTO 190 ..........................................
-----------------------------------------------------------
1080       REM ***************** DESTROY 2ND ENEMY SHIP
1090       PRINT @T,"      "
1100       FOR  J = 0 TO 60 STEP 5:
                FOR  I = 377 TO 367 STEP - 1:
                     SS = USR (I + J):
                NEXT I:
           NEXT J
1110       P = P + 1:
           IF   P = 20 PRINT @448,"YOU SAVED THE UNIVERSE
           : YOU DESTROYED 20 ALIENS":
           END
1120       PRINT @T, CHR$ (183) + " " + CHR$ (155) + " " +
           CHR$ (166) + " " + CHR$ (191)
1130       FOR  X = 1 TO 100:
           NEXT
1140       PRINT @T,"      "
1150       PRINT @T, CHR$ (183) + "      " + CHR$ (191)
1160       FOR  X = 1 TO 100:
           NEXT
1170       PRINT @T,"       "
1180       T = RND (1000)
1190       GOTO 250 ..........................................
-----------------------------------------------------------
```

SPEED SHIFTER

This program, like the program TWO LOVERS, uses data lines, but instead of printing graphic characters, it prints letters to make up the instructions for the game.

The animation in SPEED SHIFTER is created by printing the character code (140) to show speed on the speedometer. If the speed drops, it prints at a lower position, which erases the characters in front of it. Data reading can be used for a great many games, such as secret code games or business applications such as the MACHINE SERVICE RECORDS program.

SPEED SHIFTER is unique in the way it prints out instructions for the game by reading data lines containing the codes for the words in the instructions. Wow! Is a sentence that long legal?

This is a popular game with my quality control inspectors (my sons TOM and WALLY). The object of the game is to see how fast you can reach a speed of 90 mph. The problem is that if you don't shift gears at the right speed, you might blow the transmission or first gear.

The up arrow is used for shifting gears, and the right arrow is for the gas. I got the idea for this game from the speedometer in my car. They don't make 'em like they used to! Have you ever tried to get parts for a '67 Continental?

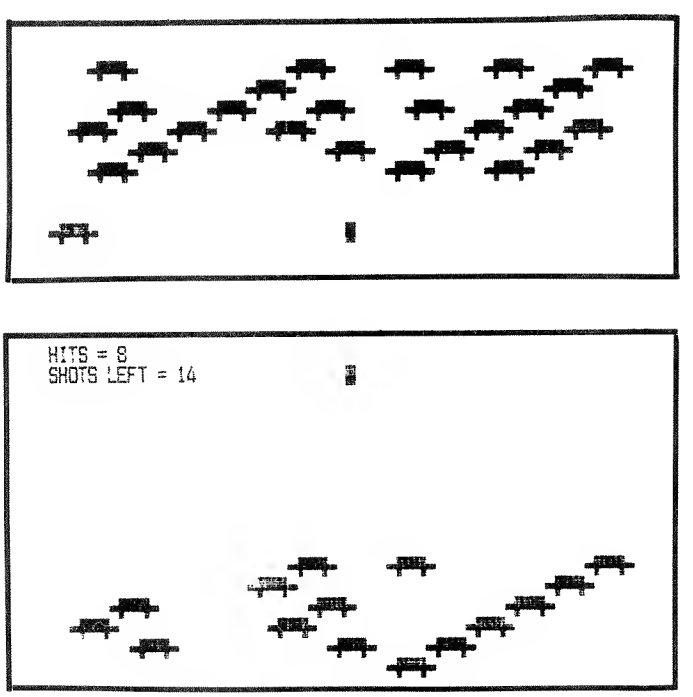


Figure 13.3 *Speed Shifter Program*

```
100 CLS
110 FOR  X = 1 TO 7:
         PRINT :
    NEXT X
120 PRINT CHR$ (23)
130 READ A:
    IF   A = 46
    THEN 170 ..................................................
140 IF   A = 1
    THEN 190 ..................................................
150 PRINT CHR$ (A);
160 GOTO 130
-------------------------------------------------------------------
170 FOR  X = 1 TO 1000:
    NEXT
180 GOTO 100
-------------------------------------------------------------------
190 I$ = INKEY$:
    IF   I$ = ""
    THEN 190 ..................................................
200 X = 1:
    CLS
210 A$ = "0     10      20      30      40      50      60
        70      80      90"
220 B$ = CHR$ (140)
230 S = 896
240 PRINT @832,A$
250 IF   S < 896S = 896
260 IF   S > 958S = 958
270 PRINT @S,B$
280 PRINT @810,"TIME = ";L;
290 L = L + 1
300 IF   S = 958 PRINT @448,"YOU WON THE SPEED SHIFTER R
         ACE IN ";L - 1;"SECONDS":
         END ..................................................
310 IF   P < 30 AND X = 3 PRINT @448,"GOING TOO SLOW FOR
          3RD GEAR...DROPPED YOUR TRANSMISSION":
         END ..................................................
320 C = S
330 IF   P > 26 AND X = 1 PRINT @448,"YOU JUST BLEW YOUR
          ENGINE IN 1ST GEAR":
         END ..................................................
340 IF   P > 48 AND X = 2 PRINT @448,"THERE GOES SECOND
         GEAR":
         END ..................................................
350 IF   PEEK (14400) = 32
    THEN S = C:
         GOTO 270 .............................................
360 IF   PEEK (14400) = 64
    THEN S = S + 1:
         P = P + 1:
         GOTO 250 .............................................
370 IF   PEEK (14400) = 8X = X + 1
380 IF   X = 1 PRINT @768,"1ST GEAR";
390 IF   X = 2 PRINT @768,"2ND GEAR";
400 IF   X = 3 PRINT @768,"3RD GEAR";
410 S = S - 1:
    PRINT @C," "
420 IF   S < 896S = 896
430 IF   S > 958S = 958
440 P = P - 1:
    IF   P < 0P = 0
450 GOTO 270
-------------------------------------------------------------------
```

```
460 DATA 84,72,73,83,32,73,83,32,84,72,69,32,83,80,69,69
    ,68,32,83,72,73,70,84,69,82,32,82,65,67,69,46,83,72,
    73,70,84,32,71,69,65,82,83,32,65,83,32,89,79,85,32,6
    8,82,73,86,69,46,72,73,84,32,84,72,69,32,85,80,32,65
    ,82,82,79,87,32,84,79,32
470 DATA 83,72,73,70,84,32,71,69,65,82,83,46,65,78,68,32
    ,84,72,69,32,82,73,71,72,84,32,65,82,82,79,87,32,70,
    79,82,32,84,72,69,32,71,65,83,46,83,69,69,32,72,79,8
    7,32,70,65,83,84,32,89,79,85,32,67,65,78,32,82,69,65
    ,67,72,32,57,48,,77,80,72,46
480 DATA 72,73,84,32,69,78,84,69,82,32,84,79,32,80,76,65
    ,89,46,1
```

14

Pushing BASIC to Its Limits

Pushing BASIC code to its limits would be a good name for SPACE ARCADE! In this game there are 30 little robots on the screen.

Defining the Robots

The program starts by defining one robot in three different positions: once with both feet down, once with one leg raised and last with the other.

This is done in lines 140 to 170. Then we jump to lines 200 to 260 and print 10 robots across the screen in the first position. Also, we point a string containing 128 characters to the top two lines of our screen.

This string contains 10 robots which all look alike. We do this for each of the original robots. After this is done, we w have three new strings, each containing 10 robots in different positions.

Marching Robots

We now print the first string at position 0 on the screen, next the second string, and finally the third. Then we print a clear string at position 0 and move the robots down. This creates the appearance of robots marching down the screen. We next convert all 30 robots into an array and begin the game.

Checking the Robots

As each robot moves out of the array, we keep checking the array and screen loactions so that we don't try to move down a robot which does'nt exist any more. This is taken care of in line 320. If the random robot selector in line 300 picks a robot position that does'nt exist, we go back and select another position.

Moving and Shooting

The player moves back and forth across the bottom of the screen by pressing the left and right arrows and can shoot back at the robots by using the up arrow key. If you shoot all the robots, 30 new robots come marching down the screen.

I'm Working as Fast as I Can!

BASIC has quite a time trying to follow this code, but not half as much as the programmer had! After completing this game, I made a few changes in certain sections of the code, and then I compiled this program for greater speed. The changes were a major undertaking, but the end results were worth it.

In other chapters, we are going to investigate some machine-language subroutines and also some utility programs. These will make your BASIC programs very fast and at the same time will help you eliminate some of the work of writing programs.

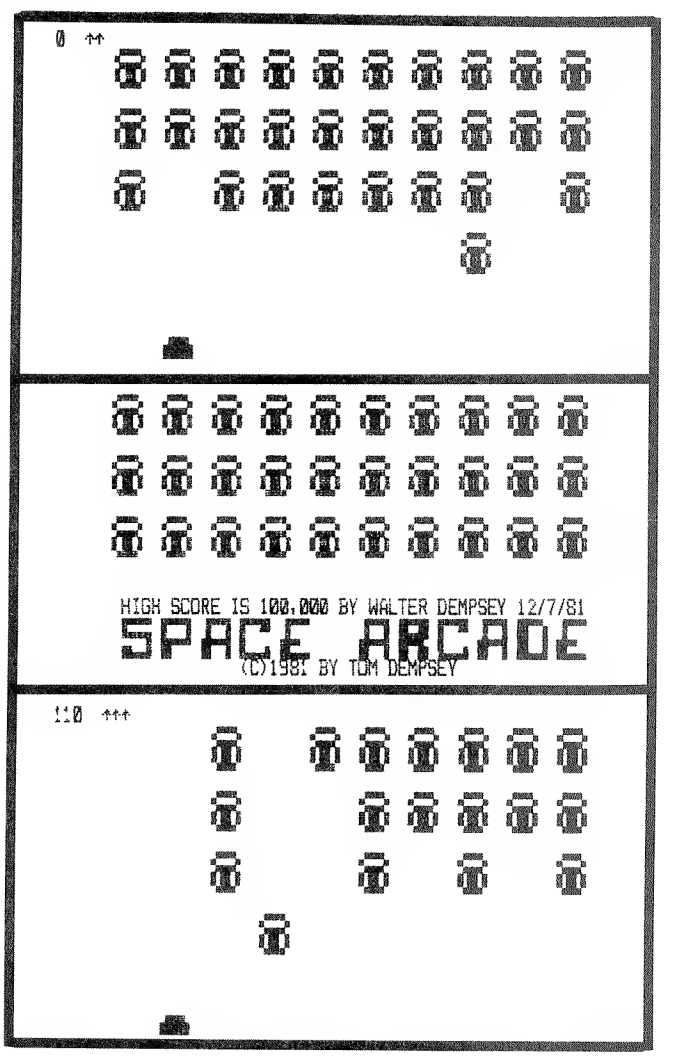


Figure 14.1 *Space Arcade Program*

```
100 CLEAR 2000:
    PL = 3:
    DIM S(30)
110 CLS :
    GOSUB 780:
    PRINT @768,A1$;:
    N = 30:
    E = 16328
120 PRINT @712,"HIGH SCORE IS 100,000 BY WALTER DEMPSEY
    12/7/81";
130 FOR  X = 15360 TO 16383:
         POKE X,128:
    NEXT
140 M1$ = CHR$ (166) + CHR$ (179) + CHR$ (153) + CHR$ (2
    6) + STRING$ (3,24) + CHR$ (165) + CHR$ (159) + CHR$
    (142)
150 M2$ = CHR$ (166) + CHR$ (179) + CHR$ (153) + CHR$ (2
    6) + STRING$ (3,24) + CHR$ (141) + CHR$ (175) + CHR$
    (154)
160 M3$ = CHR$ (166) + CHR$ (179) + CHR$ (153) + CHR$ (2
    6) + STRING$ (3,24) + CHR$ (165) + CHR$ (191) + CHR$
    (154)
170 M4$ = CHR$ (128) + CHR$ (128) + CHR$ (128) + CHR$ (2
    6) + STRING$ (3,24) + CHR$ (128) + CHR$ (128) + CHR$
    (128)
180 GOSUB 530:
    GOSUB 730
190 A1$ = STRING$ (128,128):
    B4$ = A1$
200 FOR  X = 7 TO 55 STEP 5:
         PRINT @X,M1$;:
    NEXT
210 M = VARPTR (A1$):
    POKE M + 1,0:
    POKE M + 2,60:
    B1$ = A1$
220 FOR  X = 7 TO 55 STEP 5:
         PRINT @X,M2$;:
    NEXT
230 M = VARPTR (A1$):
    POKE M + 1,0:
    POKE M + 2,60:
    B2$ = A1$
240 FOR  X = 7 TO 55 STEP 5:
         PRINT @X,M3$;:
    NEXT
250 M = VARPTR (A1$):
    POKE M + 1,0:
    POKE M + 2,60:
    B3$ = A1$:
```

```
      T = 384
260 FOR  X = Ø TO T STEP 64:
         PRINT @X,B1$;:
         A = USR Ø(1111):
         PRINT @X,B2$;:
         A = USR Ø(1111):
         PRINT @X,B4$;:
    NEXT
270 PRINT @X,B3$;:
    FOR  S = X + 51 TO X + 5 STEP - 5:
         S(N) = S + 2:
         N = N - 1:
    NEXT
280 T = T - 192:
    IF   T < Ø
    THEN 290: ..................................................
    ELSE 260 ..................................................
-------------------------------------------------------------------
290 X = Ø:
    C = Ø:
    I = Ø:
    M = Ø:
    U = Ø
300 RANDOM :
    R = RND (30):
    M = 15360 + S(R):
    P = PEEK (M)
310 IF   PL = - 1
    THEN 480: ..................................................
    ELSE IF   TS > = 30
         THEN 500 ..............................................
320 IF   P < > 179
    THEN 300: ..................................................
    ELSE X = M
330 IF   S(R) < 255
    THEN ZZ = 128:
    ELSE IF   S(R) > 447
         THEN ZZ = 128:
         ELSE ZZ = 64
340 I = RND (2):
    IF   I = 2 AND PEEK (M + 192) = 179
    THEN I = Ø
350 IF   PEEK (14400) = 32 POKE E - 1,128:
         POKE E,128:
         POKE E + 1,128:
         E = E - 5
360 IF   PEEK (14400) = 64 POKE E - 1,128:
         POKE E,128:
         POKE E + 1,128:
         E = E + 5
370 IF   E < 16328
```

```
    THEN E = 16328:
    ELSE IF   E > 16373
         THEN E = 16373
380 IF   PEEK (14400) = 8
    THEN W = E - 128:
         A = USR 0(5151):
         GOSUB 460
390 POKE E - 1,190:
    POKE E,191:
    POKE E + 1,189
400 IF   I = 2 GOTO 590 .....................................
410 IF   X > 0
    THEN P = PEEK (X):
         POKE X,92
420 IF   X = E
    THEN PL = PL - 1:
         FOR  C = 1 TO 10:
              A = USR 0(7979):
              A = USR 1(0):
              NEXT :
              PRINT @0, STRING$ (64,128);:
              IF   PL = - 1
              THEN 480 ..................................
-------------------------------------------------------------
430       PRINT @0,F1;" ";:
          IF   PL > 30
          THEN PRINT STRING$ (30,"[");:
          ELSE PRINT STRING$ (PL,"[");
440       IF   X > 0
          THEN POKE X,P:
               X = X + ZZ:
               IF   X > 16383
               THEN X = 0:
               ELSE GOTO 350 ...............................
-------------------------------------------------------------
450       GOTO 290 ....................................
-------------------------------------------------------------
460       J = PEEK (W):
          IF   J = 179
          THEN PRINT @W - 15361,M4$;:
               F1 = F1 + 10:
               IF   W > 15999
               THEN RETURN : ..............................
               ELSE TS = TS + 1:
                    RETURN  ...............................
470       POKE W,91:
          POKE W,J:
          W = W - 192:
          IF   W < 15424
          THEN RETURN : ..................................
          ELSE 460 .......................................
-------------------------------------------------------------
```

```
480       PRINT @0,"SCORE =";F1;" PRESS ENTER TO PLAY AGA
          IN";
490       I$ = INKEY$ :
          IF   I$ = CHR$ (13)
          THEN RUN : ..........................................
          ELSE 490 ..........................................
-------------------------------------------------------------
500       PL = PL + 1:
          TS = 0:
          T = 384:
          W = 0
510       FOR  X = 0 TO T STEP 64:
               PRINT @X,B1$;:
               A = USR 0(1111):
               PRINT @X,B2$;:
               A = USR 0(1111):
               PRINT @X,B4$;:
          NEXT :
          PRINT @X,B3$;
520       T = T - 192:
          IF   T < 0
          THEN 290: ..........................................
          ELSE 510 ..........................................
-------------------------------------------------------------
530       M$ = CHR$ (205) + CHR$ (127) + CHR$ (10) + CHR$
          (77) + CHR$ (68) + CHR$ (62) + CHR$ (1) + CHR$
          (105) + CHR$ (211) + CHR$ (255) + CHR$ (45) + CHR$
          (32) + CHR$ (253) + CHR$ (60) + CHR$ (105) + CHR$
          (211) + CHR$ (255) + CHR$ (45) + CHR$ (32) + CHR$
          (253) + CHR$ (13) + CHR$ (16) + CHR$ (238) + CHR$
          (175)
540       M$ = M$ + CHR$ (211) + CHR$ (255) + CHR$ (201)
550       I = VARPTR (M$)
560       M = PEEK (I + 1) + PEEK (I + 2) * 256:
          IF   M > 32767
          THEN M = M - 65536
570       DEF USR 0 = M
580       RETURN  ............................................
-------------------------------------------------------------
590       PRINT @S(R) - 1,M4$;
600       FOR  C = S(R) - 1 TO 639 STEP 64:
               PRINT @C,M1$;:
               PRINT @C,M2$;:
               A = USR 0(5959):
               PRINT @C,M4$;:
          NEXT
610       IF   C + 15680 < E
          THEN PRINT @C,M4$;:
               C = C + 5:
               IF   C > 700
               THEN I = 0:
```

```
                    GOTO 420 ..................................
-------------------------------------------------------------------
  620       IF    C + 15680 > E
            THEN PRINT @C,M4$;:
                 C = C - 5:
                 IF   C < 640
                 THEN I = 0:
                      GOTO 420 ..................................
-------------------------------------------------------------------
  630       PRINT @C,M3$;:
            A = USR 0(5959)
  640       FOR  U = 15553 + C TO 16383 STEP 128:
                 P = PEEK (U):
                 POKE U,92:
                 POKE U,P
  650            IF   U = E PRINT @C,M4$;:
                      PL = PL - 1:
                      FOR  C = 1 TO 10:
                           A = USR 0(7979):
                           A = USR 1(O):
                           NEXT :
                           PRINT @0, STRING$ (64,128);:
                           TS = TS + 1:
                           IF   PL = - 1
                           THEN 480: ..........................
                           ELSE 290 ..........................
  660                 IF   PEEK (14400) = 32 POKE E - 1,128
                           :
                           POKE E,128:
                           POKE E + 1,128:
                           E = E - 5
  670                 IF   PEEK (14400) = 64 POKE E - 1,128
                           :
                           POKE E,128:
                           POKE E + 1,128:
                           E = E + 5
  680                 IF   E < 16328
                      THEN E = 16328:
                      ELSE IF   E > 16373
                           THEN E = 16373
  690                 IF   PEEK (14400) = 8
                      THEN W = E - 128:
                           A = USR 0(5151):
                           GOSUB 460
  700                 IF   W > 15871 AND I = 2 AND PEEK (14
                           400) = 0
                      THEN I = 0:
                           F1 = F1 + 90:
                           W = 0:
                           U = 16383:
                           PRINT @C,M4$;:
```

```
                    C = 0:
                    TS = TS + 1:
                    GOTO 290 ..............................
710             POKE E - 1,190:
                POKE E,191:
                POKE E + 1,189
720         NEXT U:
            GOTO 610 ..........................................
-------------------------------------------------------------------
730         V$ = CHR$ (1) + CHR$ (1) + CHR$ (4) + CHR$
            (11) + CHR$ (33) + CHR$ (255) + CHR$ (59) +
            CHR$ (35) + CHR$ (126) + CHR$ (47) + CHR$
            (203) + CHR$ (255) + CHR$ (203) + CHR$ (18
            3) + CHR$ (119) + CHR$ (11) + CHR$ (120) +
            CHR$ (177) + CHR$ (32) + CHR$ (243) + CHR$
            (201)
740         I = VARPTR (V$)
750         M = PEEK (I + 1) + PEEK (I + 2) * 256:
            IF   M > 32767
            THEN M = M - 65536
760         DEF USR 1 = M
770         RETURN  ...........................................
-------------------------------------------------------------------
780         A1$ = "         " + CHR$ (183) + CHR$ (179)
            + CHR$ (179) + " " + CHR$ (151) + CHR$ (13
            1) + CHR$ (171) + " " + CHR$ (170) + CHR$
            (131) + CHR$ (171) + " " + CHR$ (151) + CHR$
            (131) + CHR$ (143) + " " + CHR$ (170) + CHR$
            (131) + CHR$ (131) + "     " + CHR$ (170) +
            CHR$ (131) + CHR$ (171) + " " + CHR$ (191)

790         A1$ = A1$ + CHR$ (179) + CHR$ (191) + " " +
            CHR$ (151) + CHR$ (131) + CHR$ (143) + " "
            + CHR$ (170) + CHR$ (131) + CHR$ (171) + "
             " + CHR$ (191) + CHR$ (131) + CHR$ (169) +
            " " + CHR$ (170) + CHR$ (131) + CHR$ (131)
            + "                  " + CHR$ (188) + CHR$
            (176) + CHR$ (186) + " " + CHR$ (191)
800         A1$ = A1$ + CHR$ (131) + CHR$ (131) + " " +
            CHR$ (191) + CHR$ (131) + CHR$ (171) + " "
            + CHR$ (181) + CHR$ (176) + CHR$ (184) + "
             " + CHR$ (191) + CHR$ (179) + CHR$ (176) +
            "     " + CHR$ (191) + CHR$ (131) + CHR$ (
            171) + " " + CHR$ (191) + CHR$ (131) + CHR$
            (189) + " " + CHR$ (181) + CHR$ (176) + CHR$
            (184)
810         A1$ = A1$ + " " + CHR$ (191) + CHR$ (131) +
            CHR$ (171) + " " + CHR$ (191) + CHR$ (176)
            + CHR$ (186) + " " + CHR$ (191) + CHR$ (17
            9) + CHR$ (176) + "
                  " + CHR$ (40) + CHR$ (67) + CHR$ (41
```

```
                ) + CHR$ (49) + CHR$ (57) + CHR$ (56) + CHR$
                (49) + " " + CHR$ (66) + CHR$ (89) + " "
820             A1$ = A1$ + CHR$ (84) + CHR$ (79) + CHR$ (
                77) + " " + CHR$ (68) + CHR$ (69) + CHR$ (
                77) + CHR$ (80) + CHR$ (83) + CHR$ (69) +
                CHR$ (89) + "                          "
830             RETURN  ...........................................
```

Line 730 checks for the enter key, which returns us to the main move mode of the program.

Line 800 tells the computer where in memory to find the start of string$, which will become our new program created from the screen.

Line 810 takes the values that are in the screen positions, and from line 830 we get the values that are in the program lines. If this value is not an 88, we increment (A) and check again. If we find an 88, which is character (X), we POKE the screen value into this memory location.

Line 815 checks to assure we have saved past a certain screen position before printing the message "SAVING DATA."

Line 850 deletes the drawing program, because there is no reason to save it.
Lines 1000 to 1050 are the dummy string$ waiting to be filled.

Easy Does It

All the BASIC code for graphics in these games was written by my computer. Of the rest of the code, 99% was done by merging separate sections from a disk file. It's not that I'm lazy; it's just that I'm the worlds slowest typist, so I knew I had to teach my computer to do all the typing of BASIC program code for me!

You can use these methods for writing your own games. Whenever you write a subroutine that works, save it. Then you'll never have to write it again!

When you write a utility program to accomplish a task, try to write it in such a way as to make it adaptable to more than just that one need. Whenever you find yourself repeating certain steps or the same code over and over again, — that's the time to write a program so the computer can do it for you!

Don't worry about making mistakes. You can't hurt the computer. The worst you can do is lose a program. To make mistakes is to learn! But not to learn is a bad mistake.

SERVICE Records Program

SERVICE records inventory was written for a friend of mine in the office-machine repair business. He wanted a program which would list his customer accounts by name, make of machine, serial number and date of service call, as well as list all accounts. He wanted a program that was in BASIC with an automatic edit feature built in. I included the program in this book because of one nice feature it contains.

When you ask the program to list all accounts, it prints the line number of the data statements. This feature makes it very easy to edit any data you wish. The thing to remember is that the data lines should read 260, 270, 280, in increments of ten. This can be changed by adjusting lines 140 and 230.

The most important feature of this program is the use of a counter on the data lines. This gives us a means of keeping track of each data line as it's being read, — then displaying on the screen for use in editing the customer files. Remember that counting is one of the things the computer is best at, so why not make the most of its ability?

Try to let your computer do the work for you whenever possible. After all, this is what we have them for, — right?

Program Explanation

Line 10 clears screen.
Line 20 generates large print.
Lines 30 to 130 list command options.
Line 140 sets L to start of data lines and asks for user input.
Lines 170 to 180 read data lines.
Lines 190 to 250 print control logic.
Lines 260 and following are data lines.

Figure 14.2 *Service Records Program*

```
 10 CLS
 20 PRINT CHR$ (23)
 30 PRINT @452,"MACHINE SERVICE RECORDS"
 40 FOR  X = 1 TO 1000:
    NEXT
 50 CLS
 60 PRINT "DATA MAY BE LISTED BY :"
 70 PRINT
 80 PRINT "                              DATE"
 90 PRINT "                              ACCOUNT NAME"
100 PRINT "                              MACHINE"
110 PRINT "                              SER.NUMBER"
120 PRINT "                              LIST ALL / EDIT DAT
    A LINES"
130 PRINT
140 L = 500:
    PRINT :
    INPUT "HOW SHOULD I LIST";I$
141 IF    I$ = "C" PRINT "$";T:
          FOR  X = 1 TO 1000:
               NEXT
145       CLS
146       PRINT "DATA ON ";I$
```

```
 150       READ D$,N$,M$,S$,C$,C
 160       IF   I$ = D$ PRINT N$,M$,S$,C$
 170       IF   I$ = N$ PRINT D$,M$,S$,C$
 180       IF   I$ = M$ PRINT D$,N$,S$,C$
 190       IF   I$ = S$ PRINT D$,N$,M$,C$:
                LET T = C
 200       IF   I$ = "ALL" PRINT L;D$,N$,M$,S$:
                L = L + 10
 210       IF   D$ = "XXX"
           THEN 1000 ..........................................
 220       GOTO 150 ...........................................
-------------------------------------------------------------
 500       DATA 3-24-80,ACEAUTO,IBM,455357,SERVICECONT,90.
           00
 999       DATA XXX,X,X,X,X,0
1000       RESTORE :
           GOTO 140 ...........................................
-------------------------------------------------------------
```

NOTES

15

Graphic Utility Programs

In this chapter, we'll take a look at some ways to speed up our program writing. We will also take a closer look at some methods of letting the computer do the hard work for us, so we can spend more time on ideas instead of typing on the keyboard all day. After you become used to these utility programs, you should be able to complete a game program in a day or a week that would otherwise take up to a month or even three months to complete!

LSET 1K

The following subroutine can be used to transfer 1K of packed strings from your program to the screen. This is possible by using the LSET command in disk BASIC and is very fast. To use this subroutine, first pack a full screen using the AUTOGRAF COMPILER. Then insert the following lines of code:

```
1060 GOSUB 50000
1070 GOTO 1070
```

Next, add the LSET1K subroutine listed below.

Figure 15.1 *LSET1K Routine*

```
50000 A$ = A1$:
      M = VARPTR (A$):
      POKE M + 2,60:
      POKE M + 1,0:
      LSET A$ = A1$:
      POKE M + 1,192:
      LSET A$ = A2$:
      POKE M + 1,128:
      POKE M + 2,61:
      LSET A$ = A3$:
      POKE M + 1,64:
```

```
POKE M + 2,62:
LSET A$ = A4$:
POKE M + 1,0:
POKE M + 2,63:
LSET A$ = A5$:
POKE M,64:
POKE M + 1,192:
POKE M + 2,63:
LSET A$ = A6$:
RETURN
```

The following is an explanation of the LSET1K subroutine.

First we set the variable A$, which is the routine's working variable, equal to A1$. Next we find the memory address of A$ and we change that address to the first position on our screen by POKEing the least significant value of 15360 into M+1 and the most significant value into M+2. We then give the computer the LSET command, which tells the computer to move A$ to its new address which (if everything works) is now the first three lines of our screen. We continue doing this for A2$, A3$, A4$ and A5$, — each time incrementing the screen address by 192. When we get to A6$, we change the size of A$ to 64 bytes and LSET it to the last line of the screen.

STRING/FIX

The subroutine called STRING/FIX can be used to alter any 1K of packed STRING$ that you might like to make last minute changes in. To use this program, add a GOSUB after the FRAME or 1K of packed STRING$ and run your program. Use the arrow keys to draw and the arrow plus space bar to move around the screen. If you do not wish to make any changes, press the clear key, and the program will go on to the next frame (if any).

After all changes in the frame have been completed, press enter. STRING/FIX will make the changes in the packed strings of your program and continue to the next frame. After all changes have been made, hit the break key to exit and delete the STRING/FIX program from memory.

Figure 15.2 *STRING/FIX Program*

```
50000 A$ = A1$:
      M = VARPTR (A$):
      POKE M + 2,60:
      POKE M + 1,0:
      LSET A$ = A1$:
      POKE M + 1,192:
      LSET A$ = A2$:
      POKE M + 1,128:
      POKE M + 2,61:
      LSET A$ = A3$:
      POKE M + 1,64:
      POKE M + 2,62:
      LSET A$ = A4$:
      POKE M + 1,0:
      POKE M + 2,63:
      LSET A$ = A5$:
      POKE M,64:
      POKE M + 1,192:
      POKE M + 2,63:
      LSET A$ = A6$
50010 X = 0:
      Y = 0
50020 SET (X,Y)
50030 IF   PEEK (14400) = 8Y = Y - 1
50040 IF   PEEK (14400) = 16Y = Y + 1
50050 IF   PEEK (14400) = 32X = X - 1
50060 IF   PEEK (14400) = 64X = X + 1
50070 IF   PEEK (14400) = 136 RESET (X,Y):
           Y = Y - 1
50080 IF   PEEK (14400) = 144 RESET (X,Y):
           Y = Y + 1
50090 IF   PEEK (14400) = 160 RESET (X,Y):
           X = X - 1
50100 IF   PEEK (14400) = 192 RESET (X,Y):
           X = X + 1
50110 IF   PEEK (14400) = 1
      THEN 50150 ..............................................
50120 IF   PEEK (14400) = 2 RETURN  ............................
50130 IF   X < 0
      THEN X = 127:
      ELSE IF   X > 127
           THEN X = 0:
           ELSE IF   Y < 0
                THEN Y = 47:
                ELSE IF   Y > 47
                     THEN Y = 0
50140 GOTO 50020
-----------------------------------------------------------------
50150 S = 15360
50160 A$ = A1$:
```

```
      GOSUB 50170:
      A$ = A2$:
      GOSUB 50170:
      A$ = A3$:
      GOSUB 50170:
      A$ = A4$:
      GOSUB 50170:
      A$ = A5$:
      GOSUB 50170:
      A$ = A6$:
      GOSUB 50170:
      RETURN
-----------------------------------------------------------------
50170 M = VARPTR (A$)
50180 A = PEEK (M + 1) + PEEK (M + 2) * 256:
      IF   A > 32767
      THEN A1 = - 1 * (65536 - A):
           A = A1
50190 B = A + LEN (A$):
      IF   B > 32767
      THEN A1 = - 1 * (65536 - B):
           B = A1
50200 FOR  X = A TO B - 1
50210      P = PEEK (S):
           POKE X,P
50220      S = S + 1:
      NEXT X:
      RETURN
-----------------------------------------------------------------
```

The following is an explanation of the STRING/FIX program.

Line 50000 is our good old LSET1K subroutine. In lines 50010 through 50140, we have a short drawing program. At line 50160, we set A$ to each of the variables in our frame of packed strings. Next, we GOTO 50170 to find out where A$ is in memory (we are really getting the addresses for each one of the strings A1 through A6 in our program). When we get an address, we save it in (A), scan the video screen for the new graphic values for A$ and POKE them into memory. Remember that A$ is now at the same place in memory where A1$ is. When we have completed this for the length of A$, we go back and do the same for the rest of the strings and then return to move another 1K of packed strings to the screen.

Packed Strings to CHR$ Converter

The following utility will unpack your packed strings, convert them into CHR$ or STRING$ and list them out on a line printer. Each line starts like this:

1000 A1$

This utility is nice when you have a program full of packed strings and you want to send someone a listing. Be careful when you use it because the printer doesn't care how long your lines are, and the computer won't take any lines longer than 255 bytes. Don't try to take the listing from the printer and enter it into your machine if it's too long.

Figure 15.3 *UNPACK Program*

```
50000 '           PACKED / STRINGS CONVERTER
50010 A$ = A1$:
      L$ = "1000 A1$="
50020 Z1$ = "CHR$(":
      Z2$ = "STRING$(":
      Z3$ = ")":
      Z4$ = "+"
50030 FOR  X = 1 TO LEN (A$):
           Q = 0
50040      P = ASC ( MID$ (A$,X,1)):
           IF   X < LEN (A$)
           THEN Q = ASC ( MID$ (A$,X + 1,1))
50050      IF   Q = P
           THEN T = T + 1
50060      IF   T > 0 AND Q = P
           THEN 50120 ..........................................
50070      IF   T > 0 AND Q < > P
           THEN T = T + 1:
                L$ = L$ + Z2$ + MID$ ( STR$ (T),2,3) + ","
                + MID$ ( STR$ (P),2,3) + Z3$:
                T = 0:
                GOTO 50090 ..................................
50080      IF   T = 0 AND Q < > P
           THEN L$ = L$ + Z1$ + MID$ ( STR$ (P),2,3) + Z3$

50090      IF   X < LEN (A$)
           THEN L$ = L$ + Z4$
50100      IF   X < LEN (A$) LPRINT L$;:
                L$ = ""
50110      IF   X = LEN (A$) LPRINT L$:
                L$ = ""
50120 NEXT :
      END
```

Below is the explanation for UNPACK.

In line 50010, we put the address of A1$ (or the string we want to unpack) into A$. Then we make L$ equal "1000 A1$=".

Line 50020 initializes Z1$ to "CHR$(", Z2$ to "STRING$(", Z3$ to ")" and Z4$ to "+".

At line 50030 we start our loop for A$.

In line 50040, we use the MID$ function to set the variable P equal to the ASC value of the first character in A$ and Q equal to the next character in A$.

At line 50050, if Q is equal to P, we increment the counter variable (T).

In line 50060, if the second character is the same as the first, then we drop down to line 50120 and get the next value.

At line 50070, if our counter is larger than zero and our second value in A$ is different from the first value, we increment our counter and add the string "STRING$(" plus the value of (T) plus "," plus the value of (P) plus ")". Next, we GOTO 50090 to see if X is still smaller than the length of A$. If it is, we add the string "+" to the end of L$. Then we print L$ and go back for more.

In line 50080, if our counter equals zero and Q is different from P, it means that there is only one of the characters and we add "CHR$(" plus the value of P plus ")" to L$. Then we GOTO 50090 and print L$.

At line 50090, if we aren't done, we add "+" to the end of L$.

Line 50100 prints L$, and line 50110 prints L$ only if we are all finished. Line 50120 is the completion of our FOR NEXT loop.

BASIC LINE MOD

This subroutine will search your BASIC program for a certain value and change it to a new value. This comes in handy if you want to change all those LPRINT commands to PRINT commands or perhaps REMARK lines into DATA lines! More on that later.

To use this program, merge it with your BASIC program and RUN 50000.

Figure 15.4 *LINEMOD Program*

```
50000 '                    BASIC LINE MOD
50010 CLS :
      INPUT "FIND #";F:
      INPUT "CHANGE TO #";C:
      CLS
50020 Z = PEEK (16549) * 256 + PEEK (16548)
50030 IF   Z > 32767
      THEN Z1 = - 1 * (65536 - Z):
           Z = Z1
50040 PRINT @0,"SEARCHING LINE #"; PEEK (Z + 2) + PEEK (Z +
      3) * 256:
      Q = Z:
      Z = Z + 4
50050 P = PEEK (Z):
      IF   P = F
      THEN T = T + 1:
           PRINT @30,"LOCATED ";T;" TIME(S)":
           POKE Z,C
```

```
50060 IF   P < > 0
      THEN Z = Z + 1:
           GOTO 50050 ..........................................
50070 Z = Q:
      IF   PEEK (Z + 2) + PEEK (Z + 3) * 256 = 50000 END  ......
50080 Z = PEEK (Z) + PEEK (Z + 1) * 256:
      GOTO 50030
  ------------------------------------------------------------
```

The following is a breakdown of LINEMOD.

Line 50010 gets the old and new values from the user.

Line 50020 finds the start of the BASIC program we are going to change.

At line 50030, we make sure it's not larger than 32767.

In line 50040, we tell the operator which line we are looking at in memory. At line 50050, if we find the old value, we POKE in the new value and notify the operator of the change.

Line 50060 checks for the end of line. If not, then we increment the memory position and keep going.

At line 50070, if we run into the LINEMOD subroutine, we stop.

In line 50080, we jump to the next line number and keep going.

LINEFINDER

This subroutine will find a particular line number and return the starting memory address of that line. To use it, set L to the number of the line you're looking for. When it returns, L will contain the memory address of that line number. It would look like this in the command mode:

L=1000:GOSUB50000:PRINTL

Figure 15.5 *LINEFINDER Program*

```
50000 '                        LINE FINDER
50010 Z = PEEK (16549) * 256 + PEEK (16548)
50020 IF    Z > 32767
      THEN Z1 = - 1 * (65536 - Z):
           Z = Z1
50030 IF    PEEK (Z + 2) + PEEK (Z + 3) * 256 = L
      THEN L = Z:
           RETURN  ..................................................
50040 IF    PEEK (Z + 2) + PEEK (Z + 3) * 256 > L STOP
50050 Z = PEEK (Z) + PEEK (Z + 1) * 256:
      GOTO 50020
```

If you want to get really fancy with your DATA lines and read only certain lines, you can change line 50030 of the LINEFIND subroutine to this:

50030 IFPEEK(Z+2)+PEEK(Z+3)*256=L THENPOKEZ+4,147:RETURN

With a little effort in programming, you should be able to change data lines into remark lines or back any time you wish!

DISKFILE

This program will help you keep track of your disks, and is very easy to use. It starts by listing options on the screen in this way:

1 = READ DISK <> TOTAL PROGRAMS IN FILE = 0
2 = LIST PROGRAMS
3 = PROGRAM SEARCH
4 = HARD COPY
5 = SAVE DISK FILE

The first step you must take to make use of this program is to number all your disks from 1, 2, 3, . . etc. After this is done, you're ready to begin the diskfile program.

> SPECIAL NOTE: The DISKFILE program should be saved on one of your operating system disks and placed in drive 0.

Now we're ready to run the program. GOTO DISK BASIC and type RUN"DISKFILE. Then follow the steps listed below.

1. Place disk number 1, side 1 in drive 1.

2. Press key number 1, then press number 1 again and enter to enter the disk number.

3. When the screen clears and the menu returns, turn the disk over. Now press 1 and 1 again for the disk number; then hit enter.

4. Repeat these steps for each disk you want to save in your file.

After all disks are in the file (the limit is 1000 programs), press number 5 to save the file on disk. Now break the program and run again. Press number 2 to list the file. First pressing 4 and then 2 gives a hard copy. Pressing number 3 will let you search the file for a certain program name.

This program is short and has no safeguards built in. For instance, if you try to read a disk that has not been formatted or has no directory, the program will crash. I'll leave it up to you to make additions or changes to suit your needs. I seldom find programs (even ones sold for large amounts of money) to be just what I'm looking for and usually end up making alterations to them to suit my own needs.

The following paragraphs are the line comments for the program; the program listing appears at the end of this section.

At line 10, we clear sufficient string space and dimension our array to hold about 1000 program names. Lines 20-110 are the menu lines, and lines 120 and 130 check whether the printer is on when the user wants a hard copy. Line 150 gets the disk number for the file information, and line 160 calls up the disk directory.

Lines 170 to 240 scan the screen and place the program names into the array A$(N). Lines 260 - 280 save the array A$(N) on disk, and in lines 290 - 340, the program opens the file "END" and gets the value of (N) (the total number of programs that have been saved to disk). We next load in the data and print it to the screen and lineprinter.

Lines 360 - 470 search the file for the program we want and then print out the disk number that it is on. This is the program search mode. There are many different ways of writing this type of program; this is but one example. I hope it will give you ideas for other programs that can be used to control program files on the disk system.

Figure 15.6 *DISKFILE Program*

```
10 CLS :
   CLEAR 10000:
   DIM A$(1000):
   N = 1
20 CLS :
   PRINT "1 = READ DISK <> TOTAL PROGRAMS IN FILE =";N -
   1
30 PRINT "2 = LIST PROGRAMS"
40 PRINT "3 = PROGRAM SEARCH"
50 PRINT "4 = HARD COPY"
60 PRINT "5 = SAVE DISK FILE"
70 I$ = INKEY$:
   IF   I$ = ""
   THEN 70 ..................................................
80 IF   I$ = "1"
   THEN 150 .................................................
90 IF   I$ = "2"
   THEN 290 .................................................
100 IF  I$ = "3"
   THEN 360 .................................................
110 IF  I$ = "5"
   THEN 260 .................................................
120 IF  I$ = "4" AND PEEK (14312) < > 63 PRINT @220,"PR
        INTER OFF   ";:
        H$ = "N":
        GOTO 70 .............................................
130 IF  I$ = "4" AND PEEK (14312) = 63 PRINT @220,"PRIN
        TER READY";:
        H$ = "Y":
        GOTO 70 .............................................
140 GOTO 70
-----------------------------------------------------------------
150 CLS :
    INPUT "DISK NUMBER";D
160 CMD "DIR :1"
170 M = 15488
180 P = PEEK (M):
    IF   P = 32
    THEN 210 ................................................
190 A$(N) = A$(N) + CHR$ (P)
200 M = M + 1:
    GOTO 180
-----------------------------------------------------------------
210 A$(N) = STR$ (D) + " " + A$(N)
220 N = N + 1
230 P = PEEK (M):
    IF   P < > 32
    THEN T = 0:
         GOTO 180 ...........................................
240 M = M + 1:
    T = T + 1:
    IF   T > 30
    THEN T = 0:
         GOTO 20 ............................................
250 GOTO 230
-----------------------------------------------------------------
260 OPEN "O",1,"LIST":
    FOR  X = 1 TO N:
         PRINT #1,A$(X):
    NEXT :
    CLOSE
270 OPEN "O",1,"END":
    PRINT #1,N:
    CLOSE
280 GOTO 20
-----------------------------------------------------------------
290 CLS :
    OPEN "I",1,"END":
    INPUT #1,N:
```

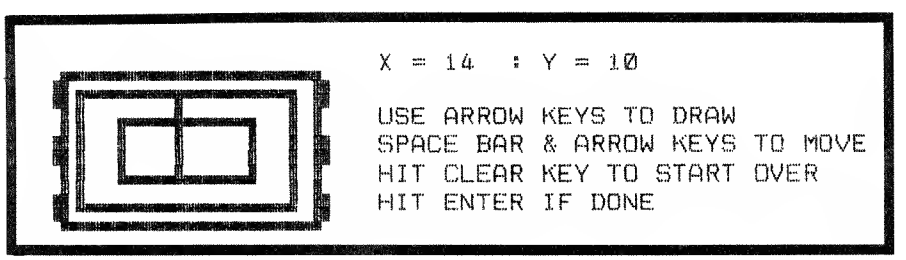
```
    CLOSE
300 OPEN "I",1,"LIST":
    FOR  X = 1 TO N - 1:
         INPUT #1,A$(X):
    NEXT :
    CLOSE
310 FOR  X = 1 TO N - 1:
         PRINT "DISK NUMBER ";A$(X)
320      IF   H$ = "Y" LPRINT "DISK NUMBER ";A$(X)
330      Q = Q + 1:
         IF   Q = 15
         THEN Q = 0:
              PRINT @960,"WAITING";:
              INPUT Z
340 NEXT X
350 PRINT @960,"WAITING";:
    INPUT Z:
    CLS :
    Q = 0:
    H$ = "N":
    GOTO 20
-------------------------------------------------------------------
360 CLS :
    OPEN "I",1,"END":
    INPUT #1,N:
    CLOSE
370 INPUT "ENTER PROGRAM WANTED";B$
380 E$ = B$
390 OPEN "I",1,"LIST"
400 FOR  X = 1 TO N - 1:
         INPUT #1,A$(X)
410      FOR  T = 1 TO LEN (A$(X))
420           IF   ASC ( MID$ (A$(X),T,1)) < 64 AND Q1 =
                   0
              THEN 440: .....................................
              ELSE Q1 = 1
430           C$ = C$ + MID$ (A$(X),T,1)
440      NEXT T
450      IF   C$ = B$
         THEN PRINT "DISK NUMBER ";A$(X):
              CLOSE :
              GOTO 350 ..................................
460      B$ = E$:
         C$ = "":
         Q1 = 0
470 NEXT X:
    CLOSE :
    PRINT "PROGRAM NOT LOCATED":
    GOTO 350
-------------------------------------------------------------------
```

ENLARGE

This program is more a subroutine than a program, although it can be used by itself. The idea is to draw a small picture on the screen and then let the computer enlarge it by about 4 times.

The program gives you a protected field to draw in. Next it scans the x,y coordinates, converts them into POKE values and duplicates the image on the screen (but in much larger graphics).

I have spent a great deal of time writing programs (or, I should say utilities and subroutines) that perform many different tasks. Examples are reverse video, reduce or enlarge, block moves of memory or screen, — even a program that writes game programs for me (or at least 90% of the program). I still have to push a few buttons. Many of these subroutines are included in this book. One of the projects I'm working on at the moment is a greatly improved version of the program that writes games. When it's completed and working properly, all the operator will have to do is enter the description of the game and the action that he wants to take place, the type of characters or graphic objects, and then the computer will create the game for you! Needless to say, this is quite a project and I have been gathering the code and subroutines for this program for about a year now.



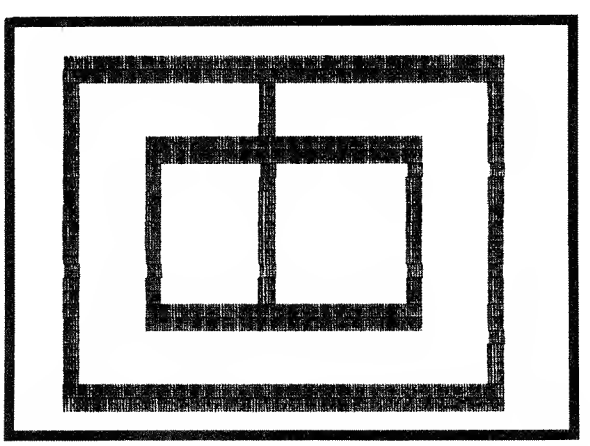


Figure 15.7 *ENLARGE Program*

```
51190 CLS :
      FOR  M = 1 TO 32:
           SET (M,2):
      NEXT :
      FOR  M = 1 TO 32:
           SET (M,18):
      NEXT :
      FOR  M = 2 TO 18:
           SET (1,M):
      NEXT :
      FOR  M = 2 TO 18:
           SET (32,M):
      NEXT :
      POKE 15424,191:
      POKE 15552,191:
      POKE 15680,191:
      POKE 15440,191:
      POKE 15568,191:
      POKE 15696,191
51200 PRINT @148,"USE ARROW KEYS TO DRAW";
51210 PRINT @212,"SPACE BAR & ARROW KEYS TO MOVE";
51220 PRINT @276,"HIT CLEAR KEY TO START OVER";
51230 PRINT @340,"HIT ENTER IF DONE";:
      X = 2:
      Y = 3:
      A = 14400
51240 SET (X,Y):
      P = PEEK (A)
51250 PRINT @20,"X =";X - 2;" : Y =";Y - 3;
51260 IF   P = 8
      THEN Y = Y - 1
51270 IF   P = 16
      THEN Y = Y + 1
51280 IF   P = 32
      THEN X = X - 1
51290 IF   P = 64
      THEN X = X + 1
51300 IF   P = 1
      THEN 51380 ..................................................
51310 IF   P = 2
      THEN 51190 ..................................................
51320 IF   P = 136 RESET (X,Y):
           Y = Y - 1
51330 IF   P = 144 RESET (X,Y):
           Y = Y + 1
51340 IF   P = 160 RESET (X,Y):
           X = X - 1
51350 IF   P = 192 RESET (X,Y):
           X = X + 1
51360 IF   X < 2X = 2:

      ELSE IF   X > 31X = 31:
           ELSE IF   Y < 3Y = 3:
                ELSE IF   Y > 17Y = 17
51370 GOTO 51240
-------------------------------------------------------------------
51380 M = 31400:
      PRINT @448,"SCANNING DATA";
51385 FOR  Y = 3 TO 17:
           FOR  X = 2 TO 31
51390           IF   POINT (X,Y)
                THEN N = 191:
                ELSE N = 128:
51395           POKE M,N:
                M = M + 1
51400      NEXT X
51410 NEXT Y
51430 CLS :
      M = M - 1
```

```
51440 S = 15360:
      T = S
51450 FOR  X = 31400 TO M:
           Q = PEEK (X)
51460      POKE S,Q:
           S = S + 1:
           Z = Z + 1:
           IF    Z = 30Z = 0:
                 S = T + 64:
                 T = T + 64
51470 NEXT X
51480 GOTO 51480
```

COPY

Did you ever have need for a machine-language subroutine but didn't want to take the time to learn machine-language? Look no further! The COPY program enables you to convert anything on the screen into a machine-language subroutine which you can call by the A=USR(0) command or by simply pressing the down arrow on the keyboard.

This program allows you to stop any program execution at any time, take a picture of whatever is on the screen, save it and recall it any time you wish. This is done by making a 1K block move and takes less than 1 second.

To take the picture, press the up arrow. When you wish to display the picture, press the down arrow. The ease of doing this allows you to save important data or pictures and recall them later without having to run the program again from the start.

How to Use COPY

To load the program, set memory size to 31488 and type SYSTEM (enter). Then type COPY (enter). After the program loads, press (/) (enter), which brings you back to BASIC. Now you can load any program you wish.

After your BASIC program is running, you can press the up arrow key to take a picture of anything you like. This takes everything on the screen and saves it in memory. To recall the picture, press the down arrow.

If you would like to call this screen from your BASIC program, insert the following lines in your program.

POKE 16526,41:POKE 16527,123
A=USR(0)

Each time the computer encounters the A=USR(0), you will have the picture on the screen.

Figure 15.8 *COPY Program*

```
7B00            00100
7B00 2A1640     00110 START     LD      HL,(4016H)
7B03 22427B     00120           LD      (JUMPER),HL
7B06 210F7B     00130           LD      HL,ENTRY
7B09 221640     00140           LD      (4016H),HL
7B0C C3CC06     00150           JP      06CCH
7B0F 014038     00160 ENTRY     LD      BC,14400
7B12 0A         00170           LD      A,(BC)
7B13 E608       00180           AND     8
7B15 281F       00190           JR      Z,DOWN
7B17 11003C     00200           LD      DE,15360
7B1A 21D47B     00210           LD      HL,31700
7B1D 010004     00220           LD      BC,1024
7B20 1A         00230 LOOP      LD      A,(DE)
7B21 77         00240           LD      (HL),A
7B22 23         00250           INC     HL
7B23 13         00260           INC     DE
7B24 0B         00270           DEC     BC
7B25 78         00280           LD      A,B
7B26 B1         00290           OR      C
7B27 20F7       00300           JR      NZ,LOOP
7B29 11003C     00310 COPY      LD      DE,15360
7B2C 21D47B     00320           LD      HL,31700
7B2F 010004     00330           LD      BC,1024
7B32 EDB0       00340           LDIR
7B34 280B       00350           JR      Z,AWAY
7B36 014038     00360 DOWN      LD      BC,14400
7B39 0A         00370           LD      A,(BC)
7B3A E610       00380           AND     16
7B3C 2803       00390           JR      Z,AWAY
7B3E C3297B     00400           JP      COPY
7B41 C3         00410 AWAY      DEFB    0C3H
7B42 E3         00420 JUMPER    DEFB    0E3H
7B43 03         00430           DEFB    003H
7B00            00440           END     START
00000 TOTAL ERRORS
AWAY    7B41
COPY    7B29
LOOP    7B20
DOWN    7B36
ENTRY   7B0F
JUMPER  7B42
START   7B00
```

Program Execution

Lines 100 - 150 set up the basic keyboard entry points.
Line 160 loads the BC register with keyboard address.
Line 170 loads A register with value in memory address 14400.
Line 180 checks for up arrow.
Line 190 If no, then go check for down arrow.
Line 200 loads DE register with screen starting address.
Line 210 loads HL register with start of save data address.
Line 220 uses BC register as counter for screen positions.
Line 230 loads A register with what was found in DE.
Line 240 load HL with value in A register.
Line 250 Add 1 to HL register.
Line 260 Add 1 to DE register.
Line 270 Subtract 1 from counter register BC.
Lines 280 - 290 load A with value in counter.
Line 300 If not 0, go back to loop and do it all again.
Line 310 loads DE register with screen starting location.
Line 320 loads HL register with starting address of data.
Line 330 loads our counter again.
Line 340 Ok, move 1k of data starting at 31700 and put it on the screen starting at 15360.
Line 350 When you're done, go back to BASIC and start checking for an up or down arrow again.
Line 360 loads BC register with keyboard address.
Line 370 loads the value at 14400 into the A register.
Line 380 Is it a down arrow?
Line 390 If not, go back to BASIC.
Line 400 If it is, then jump over to copy and do what it says.
Lines 410 - 440 define our address for BASIC and keyboard.

PCOPY

This program is practically the same as COPY, except that PCOPY sends the contents of your screen to a printer.

How to Use PCOPY

Load the program using the system command. Don't forget to set memory size to 31488. After typing SYSTEM (enter), type the word PCOPY (enter). After the program has loaded, press (/) (enter), and you will return to BASIC.

Now you are ready to load your BASIC program. Any time you wish to save the screen contents, press the up arrow. PCOPY will stop the BASIC program and send the screen contents to your printer. After this is done, control returns to the BASIC program. You can do this as often as you wish. Before using PCOPY, remember to set your printer controls from BASIC first.

Figure 15.9 *PCOPY Program*

```
9A00            00100           ORG     9A00H
9A00 2A1640     00110 START     LD      HL,(4016H)
9A03 22479A     00120           LD      (JUMPER), HL
9A06 210F9A     00130           LD      HL,ENTRY
9A09 221640     00140           LD      (4016H),HL
9A0C C3CC06     00150           JP      06CCH
9A0F 014038     00160 ENTRY     LD      BC,14400
9A12 0A         00170           LD      A,(BC)
9A13 E608       00180           AND     8
9A15 282F       00190           JR      Z,AWAY
9A17 018038     00191           LD      BC,14464
9A1A 0A         00192           LD      A,(BC)
9A1B E601       00193           AND     1
9A1D 2827       00194           JR      Z,AWAY
9A1F 11003C     00200           LD      DE,15360
9A22 210004     00210           LD      HL,1024
9A25 CD349A     00220 LOOP      CALL    TEST
9A28 1A         00230           LD      A,(DE)
9A29 32E837     00240           LD      (37E8H),A
9A2C 13         00250           INC     DE
9A2D 2B         00260           DEC     HL
9A2E 7C         00270           LD      A,H
9A2F B5         00280           OR      L
9A30 20F3       00290           JR      NZ,LOOP
9A32 2812       00300           JR      Z,AWAY
9A34 3AE837     00310 TEST      LD      A,(37E8H)
9A37 FE3F       00320           CP      03FH
9A39 20F9       00330           JR      NZ,TEST
9A3B 0E0A       00340           LD      C,0AH
9A3D 0600       00350 DELAY1    LD      B,0
9A3F 10FE       00360 DELAY2    DJNZ    DELAY2
9A41 0D         00370           DEC     C
9A42 C23D9A     00380           JP      NZ,DELAY1
9A45 C9         00390           RET
9A46 C3         00400 AWAY      DEFB    0C3H
9A47 E3         00410 JUMPER    DEFB    0E3H
9A48 03         00420           DEFB    003H
9A00            00430           END     START
00000 TOTAL ERRORS
DELAY2  9A3F
DELAY1  9A3D
TEST    9A34
LOOP    9A25
AWAY    9A46
ENTRY   9A0F
JUMPER  9A47
START   9A00
```

NOTES

16

Teaching Your Computer New Tricks

From the first day I started programming, I always believed that the computer was designed to do the work and that we, the operators and programmers, only have to tell it what we want it to do!

If you believe that too, this chapter will be of great interest to you.

Programming Tip 1

For any task or program code that will be repeated over and over again, you should write the code in such a way that it can fit into any program you write. Then you only have to write it once and just merge it into your program each time you need that certain operation.

Programming Tip 2

Try, if possible, to write code that will automatically adjust for the computer size and system that the program might be used in. This way, you won't have to rewrite it each time you want to use it in a different size machine.

Programming Tip 3

Use the fastest code or subroutine that you can write and try to keep your subroutines limited to one line, if possible.

Programming Tip 4

Break your program into small sections so the BASIC interpreter won't have to jump from line 10 to line 50000 all the time.

Make Your Computer Do It

If you use a lot of string packing in your programs, you should write a utility program that will allow you to draw graphics on the screen and then convert them into packed strings.

Listed below are some subroutines you can use to speed up your graphics.

Convert PRINT@ to X,Y Positions

```
1000 Z1=FIX(S/64):Z2=64*Z1:X=(S-Z2)*2:Y=FIX(S/64*3):RETURN
```

To use this subroutine, just make the variable (S) equal to the screen PRINT@ position, and when it returns, X,Y will be the X,Y coordinates of the same location.

Convert X,Y to POKE Positions

```
1000 XQ=INT(X/2):XR=X-(XQ*2):YQ=INT(Y/3):YR=Y-(YQ*3)
1010 PO=15360+YQ*64+XQ:RETURN
```

To use this, load X,Y with the values, and on return, PO will equal the POKE position.

Convert POKE Positions to PRINT@

```
1000 PR=PO-15360:RETURN
```

Subtract 15360 from the POKE position and you have the PRINT@ position. To find the POKE position, just add 15360 to the PRINT@ position.

Find the Start of the BASIC Program

```
1000 PRINTPEEK(16549)*256+PEEK(16548)
```

Find the End of the BASIC Program

```
1000 PRINTPEEK(16634)*256+PEEK(16633)
```

Find the Computer Memory Size

```
1000 PRINT PEEK(16561)+PEEK(16562)*256
```

Making Programs Unlistable

```
0 POKE16396,175:POKE16397,201:POKE27208,0:POKE27209,0
```

Enter line zero shown above. Next, enter the following line in the command mode:

```
POKE27206,254:POKE27207,255
```

Now try to list your program; then try to run it!

Tape or Disk?

```
1000 IFPEEK(16396)=201 THEN TAPE SYSTEM ELSE DISK SYSTEM
```

Unpacking Packed Strings

```
1000 FORX=1TOLEN(A$):PRINTASC(MID$(A$,X,1));:NEXT
```

Machine-language Subroutine Packer

Figure 16.1 *Machine-language Packer Subroutine*

```
1000 L=50000
1010 Z=PEEK(16549)*256+PEEK(16548)
1020 IFZ>32767THENZ1=-1*(65536-Z):Z=Z1
1030 IFPEEK(Z+2)+PEEK(Z+3)*256=LTHENL=Z+4:GOTO1060
1040 IFPEEK(Z+2)+PEEK(Z+3)*256>LSTOP
1050 Z=PEEK(Z)+PEEK(Z+1)*256:GOTO1020
1060 P=PEEK(L):IFP<>88THENL=L+1:GOTO1060
1070 READD:IFD=-1THEN2000ELSEPOKEL,D:L=L+1:GOTO1070
1080 DATA 1,1,4,11,33,255,59,35,126,47,203,255,203,183
1090 DATA 119,11,120,177,32,243,201,-1
2000 GOSUB50000:DELETE1000-2000
50000 M$="XXXXXXXXXXXXXXXXXXXX"
50010 Z=VARPTR(M$):DEFUSR0=PEEK(Z+1)+256*PEEK(Z+2):RETURN
```

To use this, enter the data values for the machine-language routine into line 1080 and insert the same number of X's into line 50000. Remember not to use any 0's because this will terminate the string.

Now run the program, list the program, make the USR call and the video should reverse. Tape users will have to change DEFUSR to their usual POKE16526,LS:POKE16527,MS. To do this, change line 50010 to the following:

```
50010 Z=VARPTR(M$):POKE16526,PEEK(Z+1):POKE16527,PEEK(Z+2)
```

NOTES

17

Machine-language Subroutines

The use of machine-language subroutines becomes more necessary as we get deeper into BASIC programming. The speed at which they run is needed to an even greater extent when we start working with graphics.

Out of this need for faster and more complex programs, a need for easier and simpler programming methods also arises.
As we learn more about machine-language and writing programs, we find that many of our problems really amount to only one or two, which are most critical. First is keeping our BASIC and machine-language codes from killing each other, and the second is how much memory we have to use to accomplish a given task.

Let's talk about the last condition first. If you have done your homework and investigated using one of the many machine-language compilers on the market, you soon realize that these programs are great for compiling large, complete programs. However, if you just need a one-line subroutine compiled to speed up your basic code, you realize that this is not the way to do it!

First of all, these compilers take too much memory to use them for one-liners. Most of them don't make use of very compact code, and some even dump about 1K of control code onto your compiled BASIC code, which may be just 20 bytes. This doesn't mean that the compiler is bad; it's just that most compilers weren't designed to compile one-line subroutines.

Getting back to the problem of keeping our machine code and BASIC code from destroying each other brings us to a real problem.

There Must Be a Better Way

There is a better way; in fact, there are probably many better ways. The first is to learn machine-language! Now don't get all excited about that last statement. When I say learn machine language, I don't mean learn how to write inventory control programs in machine-language.

We don't have to know that much machine-language. In fact, for writing one-line subroutines to speed up our BASIC programs, we don't have to know very much machine code at all!

What we *do* need is a way to convert our BASIC programming ideas into the machine-language logic. The first thing we have to do is start thinking in smaller terms. Thinking big is not for machine-language programmers!

One Step at a Time

There are actually very few machine-langauge instructions we need to know to write just about any subroutine we need. Don't get me wrong. It's nice if you understand all the instructions, but you won't need them all for this type of programming.

Let's take a simple BASIC subroutine and convert it step by step into a machine-language subroutine. Take the following subroutine, for example.

```
10 FORX=15360TO16383:POKEX,191:NEXT:RETURN
```

Below is how the same subroutine would look, expressed in BASIC, but looking more like machine-language.

Figure 17.1 *BASIC Subroutine*

```
10 HL=15360
20 DE=1024
30 A=191
40 POKEHL,A
50 HL=HL+1
60 DE=DE-1
70 A=DE
80 IFA>0THEN30
90 RETURN
```

This BASIC subroutine will POKE a graphic character 191 into each screen position. When it has completed this task, it returns to the code that called it.

Now let's take this subroutine a line at a time and convert it into a machine-language subroutine. The following is how the program could be expressed in assembly-language.

Figure 17.2 *Machine-language Subroutine*

```
00100          ORG     32000          ;START OF PROGRAM
00110          LD      HL,15360       ;FOR X=15360
00120          LD      DE,1024        ;TO 16383
00130 NEXT     LD      A,191          ;A=191
00140          LD      (HL),A         ;POKEX,191 (A)
00150          INC     HL             ;X=X+1
00160          DEC     DE             ;DE=16383-X
```

```
00170          LD      A,D             ;LS BYTE
00180          OR      E               ;MS BYTE
00190          JR      NZ,NEXT         ;IFDE>0THEN NEXT X
00200          RET                     ;RETURN
00210          END                     ;END
```

All those who see any similarity between the BASIC and the machine-language programs, please raise your hands! They look a lot like each other to me, but the machine-language version deals with much smaller operations than the BASIC version. The following are a few commands in machine-language and BASIC code which are very close in meaning.

Figure 17.3 *Machine-language and BASIC Commands*

```
LD   HL,15360    =    LET HL=15360
LD   (HL),A      =    POKE HL,A
RET              =    RETURN
END              =    END
DEC HL           =    HL=HL-1
INC HL           =    HL=HL+1
JP               =    GOTO
CALL             =    GOSUB
JR   NZ,NAME     =    NOT ZERO THEN GOTO NAME
JR   NZ,BC00H    =    NOT ZERO THEN GOTO MEMORY LOCATION
```

One of the best ways to learn machine-language is by looking at programs in magazines and comparing the op-codes with the remarks of the programmer.

The Merging of BASIC and Machine-code

The following programming utility will make things a little easier for you. It takes machine-code subroutines that you find or write and converts them into packed strings.

There are a couple of points I should mention before we continue. The first is that when you select machine-language code for use in your packed strings, you have to avoid using any 0's or 34's because these numbers will terminate a packed string faster then a herd of turtles!

Now comes the tricky part. How do we express a number like 15360 in our packed string? This number in our data line should look like this:

```
100 DATA 33,0,60
```

This means LD HL,15360. To do this without using any 0's is easy. All we have to do is use DEC or INC, depending on which way we want to work. Now our data line would look like the following:

```
100 DATA 33,1,60,43
```

All we are doing is loading HL with 15361 and then immediately decrementing HL so that HL holds 15360, but our string contains a 1 instead of a 0 byte, which would terminate the packed string. Now the machine-language program will look like the following when completed.

Figure 17.4 *Machine-language/Packed String Converter*

```
00100           ORG       32000
00110           LD        HL,15361
00120           DEC       HL
00130           LD        DE,1025
00140           DEC       DE
00150 NEXT      LD        A,191
00160           LD        (HL),A
00170           INC       HL
00180           DEC       DE
00190           LD        A,D
00200           OR        E
00210           JR        NZ,NEXT
00220           RET
00230           END
```

Another rule we need to remember is not to use the same string variable anywhere else in our program.

Machine-language Subroutine Packer

Figure 17.5 *Machine-Language Subroutine*

```
1000 L=50000
1010 Z=PEEK(16549)*256+PEEK(16548)
1020 IFZ>32767THENZ1=-1*(65536-Z):Z=Z1
1030 IFPEEK(Z+2)+PEEK(Z+3)*256=LTHENL=Z+4:GOTO1060
1040 IFPEEK(Z+2)+PEEK(Z+3)*256>LSTOP
1050 Z=PEEK(Z)+PEEK(Z+1)*256:GOTO1020
1060 P=PEEK(L):IFP<>88THENL=L+1:GOTO1060
1070 READD:IFD=-1THEN2000ELSEPOKEL,D:L=L+1:GOTO1070
1080 DATA 1,1,4,11,33,255,59,35,126,47,203,255,203,183
1090 DATA 119,11,120,177,32,243,201,-1
2000 GOSUB50000:DELETE1000-2000
50000 M$="XXXXXXXXXXXXXXXXXXXXX":GOTO60000
60000 Z=VARPTR(M$):DEFUSR0=PEEK(Z+1)+256*PEEK(Z+2):RETURN
```

To use this, just enter the data values for the machine-language routine into line 1080 and insert the same number of X's into line 50000. Remember not to use any 0's in the data lines because that will terminate the string.

Now RUN the program, LIST it, make the USR call, and the video should reverse. Tape users will have to change the DEFUSR to your usual POKE16526,LS:POKE16527,MS. To do this, you can change line 60000 to the following:

```
60000  Z=VARPTR(M$):POKE16526,PEEK(Z+1):POKE16527,PEEK(Z+2)
:RETURN
```

The best way to use this utility is to save it after you have packed your first machine-language subroutine . Each time you write a new routine, renumber lines 50000 to 50010, 50020, etc., so that each subroutine is in increments of 10.

After you have saved the first subroutine, you no longer need to have line 60000 in the following subroutines, so delete this line for each subsequent one. Each time you want to write a program, just load in the first subroutine and merge in all the rest. Each subroutine can use the same line 60000.

If your system won't allow you to merge programs, you can use the code below. First find where your BASIC program starts in memory. In the command mode, enter:

```
PRINTPEEK(16548);PEEK(16549)
```

Next, save these two numbers to POKE back into the second command statement below. Load the first subroutine and in the command mode, type:

```
POKE16548,PEEK(16633)-2:POKE16549,PEEK(16634) <ENTER>
```

Now load in the next subroutine and type:

```
POKE16548,233:POKE16549,66 <ENTER>
```

Repeat these steps for each subroutine you want to load. Better yet, why not write a machine-language subroutine to do this for you?

The following are a few machine-language subroutines that have been converted to be compatible with string packing.

LDVIDEO

This subroutine lets you fill the screen with any character you wish; it is especially handy for a graphic clear character 128. To call this routine, load the USR call with the value to pass to the routine, such as A=USR(128).

```
180 DATA 205,127,10,229,209,33,1,60,43,1,255,3,3,115,11,
35,120,177,32,249,201
```

REVIDEO

This subroutine does a reverse video and can be called by A=USR(0).

```
180 DATA 1,1,4,11,33,255,59,35,126,47,203,255,203,183,119,
11,120,177,32,243,201
```

SOUND

This subroutine can be called by A=USR(XXXX), where XXXX is any number between 0 and 9999.

```
180 DATA 205,127,10,77,68,62,1,105,211,255,45,32,253,60,
105,211,255,45,32,253,13,16,238,175,211,255,201
```

RSCROLL

This subroutine does a right-video scroll and can be called by A=USR(0).

```
180 DATA 33,1,251,17,1,60,27,1,1,4,11,237,176,201
```

SCRMEM48

This subroutine transfers the screen to high memory for a 48K machine and can be called by A=USR(0).

```
180 DATA 33,1,60,43,17,1,251,1,1,4,11,237,176,201
```

MEMSCR48

This subroutine moves high memory back to the screen for a 48K machine and is called by A=USR(0).

```
180 DATA 33,1,251,17,1,60,27,1,1,4,11,237,176,201
```

SCRMEM16

This subroutine transfers the screen to high memory for 16K machines and is called by A=USR(0).

```
180 DATA 33,1,60,43,17,254,123,1,1,4,11,237,176,201
```

MEMSCR16

This subroutine moves the high memory back again to the screen for 16K machines and is called by A=USR(0).

```
180 DATA 33,254,123,17,1,60,27,1,1,4,11,237,176,201
```

LOADTAPE

This subroutine loads a screen dump from tape back into the screen and is called by A=USR(0).

```
180 DATA 175,205,18,2,205,150,2,33,1,60,43,1,1,4,11,205,53,
2,119,35,11,120,177,32,246,205,248,1,201
```

SAVETAPE

This subroutine dumps the screen to tape and can be called by A=USR(0).

```
180 DATA 175,205,18,2,205,135,2,33,1,60,43,1,1,4,11,126,205,
100,2,35,11,120,177,32,246,205,248,1,201
```

Keep adding to this file and before you know it, you'll have a subroutine to do anything you want in machine-language, and you will never have to write the code again!

18

Computer Animation

The word *animation* has always had a sort of mystical sound to me, — a word with a little magical meaning to it. The dictionary defines animation as "the state of possessing life or spirit, to give natural life to, to look alive."

The object of this chapter is to use a method of programming to make our graphics look alive, or give animation to our graphic characters. The chapter will also provide a method of creating our characters to make it easier for us to give them animation.

Character Generators

Character generators are programs that help us create our graphic characters. In order to create the appearance of animation, we must be able to see our character in slightly different positions on the screen and at the same time keep changing the appearance of the character.

Perhaps many of you have made things called flip cards,' in which you take a small pad of paper and draw pictures on each page, changing each picture just a little. By flipping the pages slowly, you could create the appearance of the character moving. This illusion is animation, and we will be trying to re-create this effect using our computers instead of a pad of paper.

There are three qualities we shall be dealing with a lot in our programming. One is speed of execution, another is ease of programming and last (but not least) is realistic-looking characters. These three attributes are not the most compatible to try using at the same time, but we'll do our best using only BASIC code.

The Graphics Generator

The creation of graphic characters for animation is perhaps one of the most time-consuming parts of programming. To help with this task, let's first take a look at some facts about characters that we would most likely use in our games.

The size of our characters is usually going to stay within 5 or 6 print positions across by as high as 3 lines on the video. This is all the more true if we want more than one character on the screen at a time. These dimensions will give a character just about the size shown below.

```
XXXXXX
XXXXXX
XXXXXX
```

This is quite large enough to create almost any character we might need. If you don't believe it, just take a look at some of the best-selling games you have purchased lately.

All we need now is a program we can use to draw the characters and another to give our characters animation. How about a program that does both? Well step right up, — it has already been written.

STRING WRITER

STRING WRITER can create up to ten graphic characters for us. At the same time, we don't have to worry about all the embedded control codes such as line feeds and backspaces. Even more importantly, we can edit the lines if we need to! STRING WRITER also gives us animation for our characters.

Remember any of my favorite sayings? If you don't, I'll tell you. It's, "Make the computer do the hard work."

To use the STRING WRITER utility, press the arrow keys for the direction in which you want to draw. Use the arrow and space bar to move or erase with. Below is a list of the control keys and what each does.

(1) Write graphics into memory. Shows line number and string number. This control does not clear your picture. The reason for this is that most of your character will remain the same from frame to frame. You will only be making slight changes to each picture to create animation.

(2) Clear the picture. This key wont be used much because it's usually more convenient to remove only the parts you don't want by pressing the arrow and space bar.

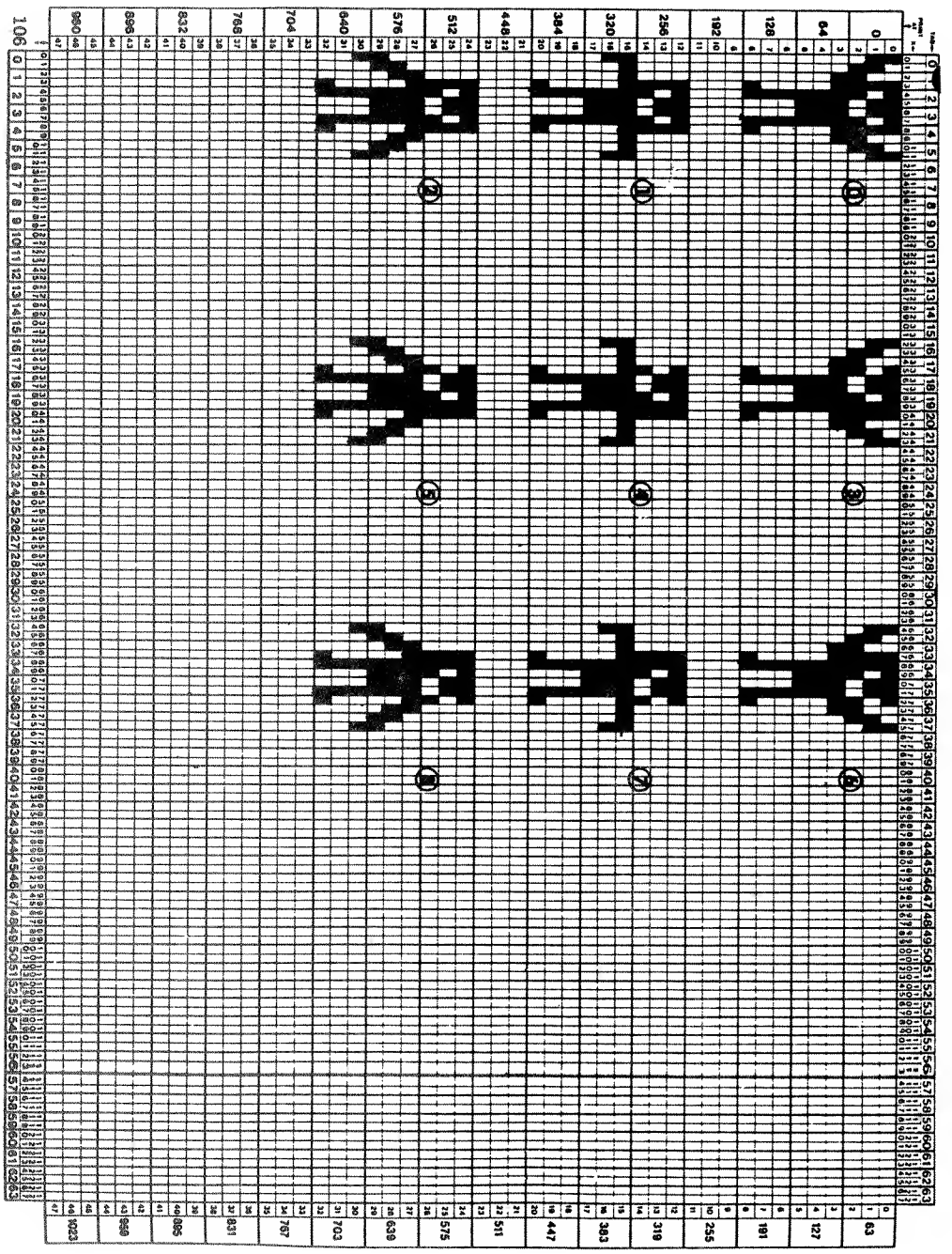
(3) Start over. This key clears the string counter and memory address to allow you to start again at line 1000. You might notice that the strings I used to print the title "STRING WRITER" on the screen are the same strings that will eventually hold your graphic characters. This method of programming helps me get more program into less memory.

(4) Exit STRING WRITER program. This control removes everything from memory, leaving only your new graphic characters.

As you draw your characters, the program will display the X,Y coordinates on the screen. Most of the time, you will want to define one of your characters as a null so that when you want to move your character, you will have a blank character ready to remove the original character from the screen. To make a blank, or null character, hold down the shift key while you press the (1) key.

For an example of how this all works, let's copy the bird character from the video display sheet (see Figure 18.1) starting with the top left corner (bird @0) and working down, next the middle row from top to bottom, and last the end row from top to bottom. After you have saved the last bird, hold down the shift key and press the (1) key to make the last character a null.

Figure 18.1 *Dodo Bird Worksheet*



We have now used all 10 characters, so the screen should clear and we can list our new program. You now have new graphic characters, labeled from A$(0) through A$(9). If you want to see the animation of your character, add the following code.

Figure 18.2 *Animation Code*

```
2000 CLS:S=460
2010 FORX=0TO8:PRINT@S,A$(X)
2020 SET(24,19):SET(30,14):SET(35,19)
2030 RESET(24,19):RESET(30,14):RESET(35,19)
2040 NEXT:GOTO2010
```

A circus dodo bird? If you would like to see him fly, enter the following code.

Figure 18.3 *Flight Code*

```
2000 CLS:S=350:FORX=0TO127:SET(X,0):SET(X,47):NEXT
2010 FORX=0TO47:SET(0,X):SET(1,X):SET(126,X):SET(127,X):NEXT
2020 A=RND(4):IFA=1THENZ=-64ELSEIFA=2THENZ=64
2030 IFA=3THENZ=-1ELSEZ=1
2040 IFA<3THENT1=0:T2=2ELSEIFA=3THENT1=3:T2=5ELSET1=6:T2=8
2050 FORX=T1TOT2:PRINT@S,A$(X);:NEXT:PRINT@S,A$(9);:L=S:S=S+Z
2060 IFPEEK(S)>128ORPEEK(S+15366)>128ORPEEK(S+15552)>128THENS=L
2070 GOTO2020
```

I hope the above gives you some idea of what can be done using the STRING WRITER utility program.

NOTES

19

Compu / Mation

Compu / Mation is actually the prototype of a program that writes complete games. Compu / Mation was created over three years ago and has now evolved into my machine-languge game-generator. This version listed here has gone through about 10 revisions over the course of three years.

After learning how to use this version, you should be able to write about 80% of your game programs without ever having to type one line of BASIC code. Three years of learning the best ways to make use of Compu / Mation make it hard (if not impossible) for me to instruct you in all the possiblities this program has. In fact, I am currently writing a complete book about the newest version of this program. I will try to give you the information that you need to start using Compu / Mation, and perhaps you will be in a better position to work with the new version by the time my next book is done.

Compu / Mation is more than just a drawing program; it's a completely new method of getting fast graphics on your screen and animation into games. It's actually more a programming method than a stand-alone program.

What's in a Name?

The name, Compu / Mation, means computer animation. I can honestly tell you (I have the publishers to prove it) that every game that Compu / Mation helped to write (over 80 complete games) has been sold! Let's see, that's 80 divided by 2 years, — that comes to 40 games a year. The reason I'm so slow is that in those two years I also had to learn how to program.

Now don't start thinking that I'm trying to impress everyone, — I'm not that kind of person. All this means is that I have devoted over 2 years to this program, and I'm proud of it. It's like getting a puppy and living with it day and night, watching it grow; you know what I mean?

Operating Instructions

The only way to learn Compu / Mation is by using it, but I'll do my best to show you my way of using Compu / Mation. When running the program, the Compu / Mation name will appear on the screen. Please wait, because the program is loading in all the machine-language subroutines at this time.

After a few moments, the menu will appear on the screen. This is the main command mode! Let's go through each of the commands one at a time and see what they do.

1 = SAVE ON TAPE

This is the tape save mode. The screen will prompt you to press enter when ready to save graphics. You must have the tape recorder ready and in record mode before you press enter! The first thing that happens is that Compu / Mation moves your drawing from its working memory position on the screen. The graphics are saved on tape in a condensed format for speed and to use less room. The tape recorder will stop and the screen will clear and return you to the command mode.

2 = READING TAPE

Pressing the number (2) key puts you in the load from tape mode. Put the tape recorder in the play mode; then press the <ENTER> key. The graphics will load into screen memory and then be transferred into the working memory location.

3 = LINE PRINTER

This will dump graphics from the screen to your line printer. If you go into any mode and change your mind, just press the (C) key to clear the command and return to the menu.

4 = COMPU / MATION

This is the animation mode. Compu / Mation lets you save up to 14 frames or complete screens in memory at one time. If you press the number (4) key and wish to save the picture you're working on, then just press the number of the frame you wish to save it in. If this is the first frame in your animation, press number (1) and it will be saved in the first location.

If you wish to run the frames in memory like a motion picture, press the (0) Key and enter the total number of frames you wish to run.

To exit from the animation mode, wait until the frame you wish to work on is on the screen, hold down the <ENTER> key and continue pressing until you return to the menu. If you would like to adjust the speed of the animation, press the up arrow to go faster or the down arrow to decrease the speed.

5 = GRAPHIC MOVE

To move an object from one place to another on the screen, move the first flashing cursor with the arrow key and position it at the top, left corner of the object you wish to move. Press the <CLEAR> key, and you will see a second flashing cursor. Move this cursor to the bottom, right corner of the object to be moved and press the <CLEAR> key again.

After a few seconds the screen will become fuzzy, signifying that the object is ready to be moved. Use the arrow keys to move the object. When done, press the <ENTER> key to return to the menu. Each time you press the <ENTER> key, Compu / Mation will save the graphics on the screen to the working memory location and return you to the command menu.

6 = TEXT INSERT

This mode lets you type words into your graphics. Move the cursor with the arrow keys to one position before the spot where you wish to enter text. Next, press the <SPACE> bar to enter the text enter mode. Enter the line of text and press <ENTER> when done.

7 = DRAWING MODE

Pressing the number (7) key places you into the drawing mode of Compu / Mation. Use the arrow keys to draw, and use the arrow and space bar to move or erase. In the drawing mode, you have some additional control keys, described below.

Pressing the (Q) key will print the X and Y positions of the cursor.

Pressing the (L) key, moving the cursor to a new location and pressing the (L) key again will draw a line between two points on the screen.

Pressing the (F) key invokes the auto fill command. To use this command, draw a square on the screen and then place the cursor one pixel down from the top center of the square. Now press the (F) key. The object will be filled in, and the cursor will return to the top left corner of your screen. The auto fill can be used to fill any shape you wish. The only requirement is that the cursor must be able to drop straight down through the object it's filling without running into any lines.

As soon as the cursor reaches a bottom line, it cancels the command and returns to the top left corner of the screen. This command can also be used to draw a line across the screen from the left to right side.

Pressing the <CLEAR> key clears the screen and returns you to the drawing mode.

8 = INVERT VIDEO

After pressing the number (8) key and then the letter (R) key, the graphics will be inverted or reversed on the screen. Pressing (R) again restores them to the original configuration.

9 = (DISK I/O)

This mode lets you either save any frame to disk or load any frame from disk by filename. You can also read the directory on drive 1. This is a very fast disk save/load and 1 uses only one gran for each picture saved.

0 = LARGE::PRINT

Pressing the (0) key places the picture in working memory onto the screen. The large print mode is good for making fancy-looking titles for your game programs. You can print 15 letters across the screen and 5 down. Pressing the (1) key moves you down one line or row of letters.

: = SAVE : TOTAL

This mode allows you to save all frames in memory at one time using the tape recorder.

P = PACK STRINGS

This is the heart of the Compu / Mation program. This mode will convert the graphics in working memory into packed strings starting at lines 3000 to 3050 using A1$ through A6$. After the screen has been converted, it will clear, and you will return to BASIC with only the packed strings left in memory. You can run these by adding the following lines:

```
1060 CLS:PRINTA1$;A2$;A3$;A4$;A5$;A6$;
1070 GOTO 1070
```

You can save them to merge later into one large program. Now you're ready to explore all the different ways to use Compu / Mation. How about eye-catching store window displays to attract customers into the stores? I'll leave the rest up to your imagination.

Figure 19.1 *Compu/Mation Program*

```
 10 DEF USR 1 = - 28672:
    DEF USR 2 = - 28652:
    DEF USR 3 = - 28630:
    DEF USR 4 = - 28603
 20 REM  *** COMPU / MATION BY TOM DEMPSEY ***
 30 CLS :
    CLEAR 1000
 40 REM  *** REVERSE VIDEO ROUTINE ***
 50 DATA 1,0,4,33,255,59,35,126,47,203,255,203,183,119,1
    1,120,177,32,243,201
 60 FOR  A = - 28672 TO - 28653:
         READ B:
         POKE A,B:
    NEXT
 70 REM  *** BLOCK MOVE ROUTINE ***
 80 FOR  A = - 28652 TO - 28634:
         READ B:
         POKE A,B:
    NEXT
 90 DATA 17,0,60,33,136,144,1,0,4,26,119,35,19,11,120,17
    7,32,247,201
100 REM  *** TAPE READ & SAVE ROUTINE ***
110 FOR  A = - 28630 TO - 28577:
         READ B:
         POKE A,B:
    NEXT
120 DATA 175,205,18,2,205,150,2,33,0,60,1,0,4,205,53,2,1
    19,35,11,120,177,32,246,205,248,1,201,175,205,18,2,2
    05,135,2,33,0,60,1,0,4,126,205,100,2,35,11,120,177,3
    2,246,205,248,1,201
130 PRINT CHR$ (23)
140 PRINT @462,"COMPU / MATION"
150 PRINT @518,"(C)1981 BY TOM DEMPSEY"
160 FOR  X = - 28536 TO - 27513:
         POKE X,128:
    NEXT
170 GOTO 480
```

```
180 A = 14400
190 Y = 0:
    X = 0
200 RESET (X,Y):
    SET (X,Y)
210 IF   PEEK (14340) = 2
    THEN I$ = "":
         FOR  Q = 15360 TO 15423:
              P = PEEK (Q):
              I$ = I$ + CHR$ (P):
              NEXT Q:
              PRINT @0,"X=";X;" Y=";Y;:
```

```
                  FOR  Q = 1 TO 1000:
                       NEXT Q:
                       PRINT @0,I$;:
                       I$ = ""
220               IF   PEEK (A) = 8Y = Y - 1
230               IF   PEEK (A) = 16Y = Y + 1
240               IF   PEEK (A) = 32X = X - 1
250               IF   PEEK (A) = 64X = X + 1
260               IF   PEEK (A) = 136:
                       GOSUB 370:
                       RESET (X,Y):
                       Y = Y - 1
270               IF   PEEK (A) = 144:
                       GOSUB 370:
                       RESET (X,Y):
                       Y = Y + 1
280               IF   PEEK (A) = 160:
                       GOSUB 370:
                       RESET (X,Y):
                       X = X - 1
290               IF   PEEK (A) = 192:
                       GOSUB 370:
                       RESET (X,Y):
                       X = X + 1
300               IF   Y < 0Y = 0:
                  ELSE IF   Y > 47Y = 47:
                       ELSE IF   X < 0X = 0:
                            ELSE IF   X > 127X = 127
310               IF   PEEK (A) = 2 FOR  M = 15360 TO 16383:

                            POKE M,128:
                            NEXT :
                            X = 0:
                            Y = 0
320                 IF   PEEK (A) = 1
                    THEN 460 ..................................
330                 IF   PEEK (14337) = 8V = USR 2(X):
                         GOSUB 760:
                         A = 14400
340                 IF   PEEK (14337) = 64
                    THEN 390 ..................................
350                 IF   PEEK (14338) = 16 GOSUB 2730:
                         RESET (X,Y):
                         FOR  T = 1 TO 100:
                              NEXT :
                              SET (X,Y)
360                      GOTO 200 ..............................
-------------------------------------------------------------------
370                      IF   Y < 0Y = 0:
                         ELSE IF   Y > 47Y = 47:
                              ELSE IF   X < 0X = 0:
```

```
                              ELSE IF   X > 127X = 1
                                        27
380                           RETURN  ..............................
-------------------------------------------------------------------
390                           A = X:
                              B = Y
400                           X = X + 1:
                              GOSUB 440:
                              IF   POINT (X,Y)
                              THEN 410: ............................
                              ELSE SET (X,Y):
                                   GOTO 400 ........................
-------------------------------------------------------------------
410                           X = A
420                           X = X - 1:
                              GOSUB 440:
                              IF   POINT (X,Y)
                              THEN 430: ............................
                              ELSE SET (X,Y):
                                   GOTO 420 ........................
-------------------------------------------------------------------
430                           X = A:
                              Y = Y + 1:
                              GOSUB 440:
                              IF   POINT (X,Y)
                              THEN 180: ............................
                              ELSE SET (X,Y):
                                   GOTO 400 ........................
-------------------------------------------------------------------
440                           IF   X < 0 OR X > 127 OR Y > 47
                              THEN 180: ............................
                              ELSE RETURN  .........................
-------------------------------------------------------------------
450                           REM  *** SAVE IN MEMORY ***
460                           A = USR 2(X)
470                           REM  *** COMMAND MODE ROUTINE **
                              *
480                           CLS
490                           PRINT "* COMMAND MODE *":
                              PRINT
500                           PRINT "1 = SAVE ON TAPE"
510                           PRINT "2 = READING TAPE"
520                           PRINT "3 = LINE PRINTER"
530                           PRINT "4 = COMPU/MATION"
540                           PRINT "5 = GRAPHIC MOVE"
550                           PRINT "6 = TEXT  INSERT"
560                           PRINT "7 = DRAWING MODE"
570                           PRINT "8 = INVERT VIDEO"
580                           PRINT "9 = ( DISK I/O )"
590                           PRINT "0 = LARGE::PRINT"
600                           PRINT ": = SAVE : TOTAL"
```

```
610                     PRINT "P = PACK STRINGS"
620                     I$ = INKEY$ :
                        IF   I$ = ""
                        THEN 620 ..............................
630                     IF   I$ = "P"
                        THEN 2660 .............................
640                     IF   I$ = "Ø"
                        THEN 2190 .............................
650                     IF   I$ = ":"
                        THEN 2530 .............................
660                     IF   I$ = "7"
                        THEN GOSUB 2130:
                             GOTO 180 .........................
670                     ON VAL (I$) GOTO 690,850,910,980
                        ,1410,1730,1920,1980 .................
-------------------------------------------------------------
680                     GOTO 620 ..............................
-------------------------------------------------------------
690                     REM  *** TAPE SAVE ROUTINE ***
700                     CLS :
                        PRINT "WHEN READY TO SAVE GRAPHI
                        CS HIT ENTER"
710                     I$ = INKEY$ :
                        IF   I$ = ""
                        THEN 710 ..............................
720                     IF   I$ = "C" GOSUB 2130:
                             GOTO 180 .........................
730                     GOSUB 2130
740                     A = USR 4(X)
750                     GOTO 470 ..............................
-------------------------------------------------------------
760                     CLS
770                     INPUT "X,Y CENTER OF CIRCLE";X1,
                        Y1
780                     INPUT "SIZE OR RADIUS OF CIRCLE"
                        ;R
790                     GOSUB 2130:
                        E = 128 / 48
800                     FOR  T = Ø TO 6.3 STEP 1 / (R +
                             R)
810                          X = INT (E * R * COS (T) +
                             X1 + Ø.5)
820                          Y = INT (R * SIN (T) + Y1 +
                             Ø.5)
830                          IF   X < Ø OR X > 127 OR Y <
                                  Ø OR Y > 47
                             THEN NEXT T
840                          SET (X,Y):
                        NEXT T:
                        RETURN  ..............................
-------------------------------------------------------------
```

```
 850                    REM  *** TAPE READ ROUTINE ***
 860                    CLS :
                        PRINT "WHEN READY TO READ TAPE H
                        IT ENTER"
 870                    I$ = INKEY$ :
                        IF   I$ = ""
                        THEN 870 ..............................
 880                    IF   I$ = "C" GOSUB 2130:
                             GOTO 180 .........................
 890                    A = USR 3(X)
 900                    GOTO 450 ..............................
-------------------------------------------------------------------
 910                    REM  *** LINEPRINTER ROUTINE ***

 920                    CLS :
                        PRINT "WHEN READY TO LINEPRINT H
                        IT ENTER"
 930                    I$ = INKEY$ :
                        IF   I$ = ""
                        THEN 930 ..............................
 940                    IF   I$ = "C" GOSUB 2130:
                             GOTO 180 .........................
 950                    GOSUB 2130:
                        LPRINT CHR$ (27); CHR$ (66)
 960                    FOR  X = 15360 TO 16383:
                             P = PEEK (X):
                             LPRINT CHR$ (P);:
                        NEXT
 970                    GOTO 180 ..............................
-------------------------------------------------------------------
 980                    REM  *** COMPU / MATION ***
 990                    CLS :
                        PRINT "COMPU / MATION"
1000                    PRINT "ENTER FRAME NUMBER (1-14)
                         / ENTER 0 TO RUN"
1010                    INPUT I$
1020                    IF   I$ = "0"
                        THEN 1230 .............................
1030                    GOSUB 2130
1040                    B = - 28652
1050                    POKE B + 4,0
1060                    IF   I$ = "1" POKE B + 5,192
1070                    IF   I$ = "2" POKE B + 5,196
1080                    IF   I$ = "3" POKE B + 5,200
1090                    IF   I$ = "4" POKE B + 5,204
1100                    IF   I$ = "5" POKE B + 5,208
1110                    IF   I$ = "6" POKE B + 5,212
1120                    IF   I$ = "7" POKE B + 5,216
1130                    IF   I$ = "8" POKE B + 5,220
1140                    IF   I$ = "9" POKE B + 5,224
1150                    IF   I$ = "10" POKE B + 5,228
```

```
1160                    IF    I$ = "11" POKE B + 5,232
1170                    IF    I$ = "12" POKE B + 5,236
1180                    IF    I$ = "13" POKE B + 5,240
1190                    IF    I$ = "14" POKE B + 5,244
1200                    A = USR 2(X):
                        CLS
1210                    POKE B + 4,136:
                        POKE B + 5,144
1220                    GOTO 470 ..............................
-------------------------------------------------------------
1230                    REM  *** RUN ANIMATION ***
1240                    CLS :
                        PRINT "* ANIMATION MODE *"
1250                    PRINT :
                        INPUT "ENTER NUMBER OF FRAMES IN
                         MEMORY";I
1260                    Q = 0
1270                    B = - 28652
1280                    POKE B + 9,237:
                        POKE B + 10,176:
                        POKE B + 11,201
1290                    Z = 192:
                        POKE B + 4,0:
                        T = 500
1300                    CLS
1310                    POKE B + 5,Z:
                        Z = Z + 4:
                        A = USR 2(X)
1320                    FOR  X = 1 TO T:
                        NEXT
1330                    IF    PEEK (14400) = 8T = T - 100
                              :
                              IF    T < 0T = 0
1340                    IF    PEEK (14400) = 16T = T + 10
                              0:
                              IF    T > 1000T = 1000
1350                    IF    PEEK (14400) = 1
                        THEN 1380 .............................
1360                    Q = Q + 1:
                        IF    Q = I
                        THEN Q = 0:
                              Z = 192
1370                    GOTO 1310 .............................
-------------------------------------------------------------
1380                    Q = 0:
                        POKE B + 9,26:
                        POKE B + 10,119:
                        POKE B + 11,35
1390                    POKE B + 4,136:
                        POKE B + 5,144
1400                    GOTO 450 ..............................
-------------------------------------------------------------
```

```
1410                    REM  *** GRAPHIC MOVE MODE ***
1420                    CLS :
                        PRINT "* GRAPHIC MOVE MODE *":
                        FOR  X = 1 TO 1000:
                        NEXT :
                        CLS
1430                    GOSUB 2130
1440                    A = 15360
1450                    P = PEEK (A):
                        POKE A,191:
                        FOR  X = 1 TO 10:
                        NEXT :
                        POKE A,P
1460                    IF   PEEK (14400) = 8A = A - 64
1470                    IF   PEEK (14400) = 16A = A + 64

1480                    IF   PEEK (14400) = 32A = A - 1
1490                    IF   PEEK (14400) = 64A = A + 1
1500                    IF   A < 15360A = 15360:
                        ELSE IF   A > 16320A = 16320
1510                    IF   PEEK (14400) = 2
                        THEN POKE 14400,0:
                             GOTO 1530 .....................
1520                    GOTO 1450 .........................
-------------------------------------------------------------
1530                    B = 15360
1540                    P = PEEK (B):
                        POKE B,191:
                        FOR  X = 1 TO 10:
                        NEXT :
                        POKE B,P
1550                    IF   PEEK (14400) = 8B = B - 64
1560                    IF   PEEK (14400) = 16B = B + 64

1570                    IF   PEEK (14400) = 32B = B - 1
1580                    IF   PEEK (14400) = 64B = B + 1
1590                    IF   B < 15360B = 15360:
                        ELSE IF   B > 16320B = 16320
1600                    IF   PEEK (14400) = 2
                        THEN 1620 .........................
1610                    GOTO 1540 .........................
-------------------------------------------------------------
1620                    FOR  X = A TO B:
                             P = PEEK (X):
                             M$ = M$ + CHR$ (P):
                             IF   LEN (M$) > 245
                             THEN M$ = "":
                                  GOTO 450 ..............
1630                    NEXT X
1640                    C = A - 15360:
                        PRINT @C,M$;
```

```
1650                    IF   PEEK (14400) = 8A = A - 64
1660                    IF   PEEK (14400) = 16A = A + 64

1670                    IF   PEEK (14400) = 32A = A - 1
1680                    IF   PEEK (14400) = 64A = A + 1
1690                    IF   A < 15360A = 15360:
                        ELSE IF   A > 16320A = 16320
1700                    IF   PEEK (14400) = 1
                        THEN M$ = "":
                             GOTO 450 .....................
1710                    IF   PEEK (14400) = 2
                        THEN 1440 ........................
1720                    GOTO 1640 ........................
-------------------------------------------------------------
1730                    REM  *** TEXT INSERT MODE ***
1740                    CLS :
                        PRINT "* TEXT INSERT MODE *":
                        FOR  X = 1 TO 1000:
                        NEXT :
                        CLS
1750                    GOSUB 2130
1760                    A = 15360
1770                    P = PEEK (A):
                        POKE A,143:
                        POKE A,P
1780                    B = A
1790                    IF   PEEK (14400) = 8A = A - 64
1800                    IF   PEEK (14400) = 16A = A + 64

1810                    IF   PEEK (14400) = 32A = A - 1
1820                    IF   PEEK (14400) = 64A = A + 1
1830                    IF   A < 15360A = B:
                        ELSE IF   A > 16383A = B
1840                    IF   PEEK (14400) = 1
                        THEN 450 .........................
1850                    IF   PEEK (14400) = 128
                        THEN 1870 ........................
1860                    GOTO 1770 ........................
-------------------------------------------------------------
1870                    I$ = "":
                        I$ = INKEY$ :
                        IF   I$ = ""
                        THEN 1870 ........................
1880                    IF   PEEK (14400) = 1
                        THEN 450 .........................
1890                    POKE A, ASC (I$):
                        A = A + 1
1900                    GOTO 1870 ........................
-------------------------------------------------------------
1910                    REM  *** CALL REVERSE VIDEO ***
1920                    CLS :
```

```
                    PRINT "* INVERT VIDEO MODE *"
1930                FOR  X = 1 TO 1000:
                    NEXT
1940                GOSUB 2130
1950                IF   PEEK (14340) = 4A = USR 1(X
                    )
1960                IF   PEEK (14400) = 1
                    THEN 460 ..............................
1970                GOTO 1950 .............................
-------------------------------------------------------------
1980                CLS
1990                PRINT :
                    PRINT "PRESS (S) = SAVE  (L) = L
                    OAD  (D) = DIR  (C) = COMMAND MO
                    DE"
2000                I$ = INKEY$ :
                    IF   I$ = "S"
                    THEN 2010: ............................
                    ELSE IF   I$ = "L"
                         THEN 2070: .......................
                         ELSE IF   I$ = "C"
                              THEN 480: ...................
                              ELSE IF   I$ = "D"
                                   THEN CMD "DIR :1"
                                        :
                                        GOTO 1990: .......
                                        : .................
                                   ELSE 2000 ..............
2010                INPUT "ENTER FILESPEC TO SAVE ";
                    B$
2020                F$ = "DUMP " + B$ + ":1 15360 16
                    383 26810"
2030                GOSUB 2130
2040                CMD "F$
2050                GOTO 470 ..............................
-------------------------------------------------------------
2060                REM                  LOAD FROM DI
                    SK
2070                REM
2080                INPUT "ENTER FILESPEC TO LOAD ";
                    B$
2090                CLS
2100                F$ = "LOAD " + B$
2110                CMD "F$
2120                A = USR 2(X):
                    GOTO 470 ..............................
-------------------------------------------------------------
2130                REM  *** BLOCK MOVE TO SCREEN **
                    *
2140                B = - 28652
2150                POKE B + 9,237:
```

```
                        POKE B + 10,176:
                        POKE B + 11,201
2160                    A = USR 2(X)
2170                    POKE B + 9,26:
                        POKE B + 10,119:
                        POKE B + 11,35
2180                    RETURN  ..............................
-------------------------------------------------------------
2190                    GOSUB 2130:
                      ' *** LARGE PRINT MODE ***
2200                    CLEAR 1000:
                        M = 15360
2210                    T = M
2220                    A$ = INKEY$ :
                        IF   A$ = ""
                        THEN 2220 ............................
2230                    IF   A$ = "A" POKE M,170:
                             POKE M + 1,131:
                             POKE M + 2,171:
                             POKE M + 64,191:
                             POKE M + 65,131:
                             POKE M + 66,171
2240                    IF   A$ = "B" POKE M,191:
                             POKE M + 1,131:
                             POKE M + 2,149:
                             POKE M + 64,191:
                             POKE M + 65,179:
                             POKE M + 66,187
2250                    IF   A$ = "C" POKE M,151:
                             POKE M + 1,131:
                             POKE M + 2,143:
                             POKE M + 64,181:
                             POKE M + 65,176:
                             POKE M + 66,184
2260                    IF   A$ = "D" POKE M,191:
                             POKE M + 1,131:
                             POKE M + 2,169:
                             POKE M + 64,191:
                             POKE M + 65,176:
                             POKE M + 66,186
2270                    IF   A$ = "E" POKE M,170:
                             POKE M + 1,131:
                             POKE M + 2,131:
                             POKE M + 64,191:
                             POKE M + 65,179:
                             POKE M + 66,176
2280                    IF   A$ = "F" POKE M,170:
                             POKE M + 1,131:
                             POKE M + 2,131:
                             POKE M + 64,191:
                             POKE M + 65,131
```

```
2290          IF   A$ = "G" POKE M,151:
                   POKE M + 1,131:
                   POKE M + 2,139:
                   POKE M + 64,181:
                   POKE M + 65,178:
                   POKE M + 66,191
2300          IF   A$ = "H" POKE M,191:
                   POKE M + 2,170:
                   POKE M + 64,191:
                   POKE M + 65,131:
                   POKE M + 66,191
2310          IF   A$ = "I" POKE M,170:
                   POKE M + 64,191:
                   M = M - 2
2320          IF   A$ = "J" POKE M,131:
                   POKE M + 1,191:
                   POKE M + 2,131:
                   POKE M + 64,180:
                   POKE M + 65,191
2330          IF   A$ = "K" POKE M,191:
                   POKE M + 1,160:
                   POKE M + 2,159:
                   POKE M + 64,191:
                   POKE M + 65,131:
                   POKE M + 66,189
2340          IF   A$ = "L" POKE M,170:
                   POKE M + 64,191:
                   POKE M + 65,176:
                   POKE M + 66,176
2350          IF   A$ = "M" POKE M,191:
                   POKE M + 1,171:
                   POKE M + 2,171:
                   POKE M + 64,191:
                   POKE M + 66,190
2360          IF   A$ = "N" POKE M,191:
                   POKE M + 1,175:
                   POKE M + 2,170:
                   POKE M + 64,191:
                   POKE M + 66,191
2370          IF   A$ = "O" POKE M,170:
                   POKE M + 1,131:
                   POKE M + 2,171:
                   POKE M + 64,191:
                   POKE M + 65,176:
                   POKE M + 66,186
2380          IF   A$ = "P" POKE M,151:
                   POKE M + 1,131:
                   POKE M + 2,171:
                   POKE M + 64,191:
                   POKE M + 65,131:
                   POKE M + 66,131
```

```
2390    IF   A$ = "Q" POKE M,151:
             POKE M + 1,131:
             POKE M + 2,149:
             POKE M + 64,181:
             POKE M + 65,187:
             POKE M + 66,181
2400    IF   A$ = "R" POKE M,191:
             POKE M + 1,179:
             POKE M + 2,191:
             POKE M + 64,191:
             POKE M + 65,131:
             POKE M + 66,189
2410    IF   A$ = "S" POKE M,183:
             POKE M + 1,179:
             POKE M + 2,179:
             POKE M + 64,188:
             POKE M + 65,176:
             POKE M + 66,186
2420    IF   A$ = "T" POKE M,131:
             POKE M + 1,171:
             POKE M + 2,131:
             POKE M + 65,191
2430    IF   A$ = "U" POKE M,170:
             POKE M + 2,170:
             POKE M + 64,191:
             POKE M + 65,176:
             POKE M + 66,186
2440    IF   A$ = "V" POKE M,149:
             POKE M + 2,186:
             POKE M + 64,141:
             POKE M + 65,176:
             POKE M + 66,143
2450    IF   A$ = "W" POKE M,191:
             POKE M + 2,175:
             POKE M + 64,191:
             POKE M + 65,186:
             POKE M + 66,186
2460    IF   A$ = "X" POKE M,175:
             POKE M + 1,176:
             POKE M + 2,159:
             POKE M + 64,190:
             POKE M + 65,131:
             POKE M + 66,189
2470    IF   A$ = "Y" POKE M,159:
             POKE M + 2,191:
             POKE M + 64,179:
             POKE M + 65,179:
             POKE M + 66,191
2480    IF   A$ = "Z" POKE M,131:
             POKE M + 1,179:
             POKE M + 2,143:
```

```
                         POKE M + 64,191:
                         POKE M + 65,188:
                         POKE M + 66,188
2490                     IF   A$ = CHR$ (13)
                         THEN 450 ..............................
2500                     IF   A$ = "1"T = T + 192:
                         M = T - 4
2510                     M = M + 4
2520                     GOTO 2220 .............................
-------------------------------------------------------------------
2530                     CLS
2540                     INPUT "ENTER TOTAL NUMBER TO SAV
                         E";I:
                         CLS
2550                     Q = 0
2560                     B = - 28652
2570                     POKE B + 9,237:
                         POKE B + 10,176:
                         POKE B + 11,201
2580                     POKE B + 4,0
2590                     Z = 192
2600                     FOR  X = 1 TO I
2610                          POKE B + 5,Z:
                              A = USR 2(X)
2620                          A = USR 4(X)
2630                          Z = Z + 4:
                         NEXT X
2640                     Q = 0:
                         POKE B + 9,26:
                         POKE B + 10,119:
                         POKE B + 11,35
2650                     POKE B + 4,136:
                         POKE B + 5,144:
                         GOTO 470 ..............................
-------------------------------------------------------------------
2660                     GOSUB 2130:
                         A = - 30053
2670                     FOR  X = 15360 TO 16382
2680                          IF   X > 15375 PRINT @0,"I'
                              M PACKING ";
2690                          B = PEEK (X)
2700                          C = PEEK (A):
                              IF   C < > 88
                              THEN A = A + 1:
                                   GOTO 2700 ..................
2710                          IF   C = 88 POKE A,B:
                                   A = A + 1:
                                   NEXT X:
                                   CLS
2720                          DELETE 10 - 2970
2730                          IF   L1 = 0
```

```
                              THEN L1 = 1:
                                   A1 = X:
                                   B = Y:
                                   RETURN  .....................
2740                          IF   L1 = 1
                              THEN L1 = Ø:
                                   C = X:
                                   D = Y
2750                          IF   A1 = C
                              THEN RETURN : ....................
                              ELSE IF   B = D
                                   THEN RETURN  ................
2760                          IF   ABS (C - A1) < ABS (D -
                                   B) GOTO 288Ø ................
2770                          Z = (D - B) / ABS (C - A1)
2780                          IF   C > A1 GOTO 283Ø ............
2790                          FOR  I = A1 TO C STEP - 1
2800                               SET (I,B):
                                   B = B + Z:
                                   IF   B < Ø
                                   THEN B = Ø
2810                          NEXT I
2820                          RETURN  ..........................
-------------------------------------------------------------------
2830                          FOR  I = A1 TO C
2840                               SET (I,B)
2850                               B = B + Z:
                                   IF   B < Ø
                                   THEN B = Ø
2860                          NEXT I
2870                          RETURN  ..........................
-------------------------------------------------------------------
2880                          Z = (C - A1) / ABS (C - B):

                              IF   D > B GOTO 294Ø .............
2890                          FOR  I = B TO D STEP - 1
2900                               SET (A1,I)
2910                               A1 = A1 + Z:
                                   IF   A1 < Ø
                                   THEN A1 = Ø
2920                          NEXT I
2930                          RETURN  ..........................
-------------------------------------------------------------------
2940                          FOR  I = B TO D
2950                               SET (A1,I)
2960                               A1 = A1 + Z:
                                   IF   A1 < Ø
                                   THEN A1 = Ø
2970                          NEXT I
2980                          RETURN  ..........................
```

```
2990    A1$ = "XXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXX"
3000    A2$ = "XXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXX"
3010    A3$ = "XXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXX"
3020    A4$ = "XXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXX"
3030    A5$ = "XXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXX"
3040    A6$ = "XXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXXXXXXXXXXXX
        XXXXXXXXXXXXXXXX"
```

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